

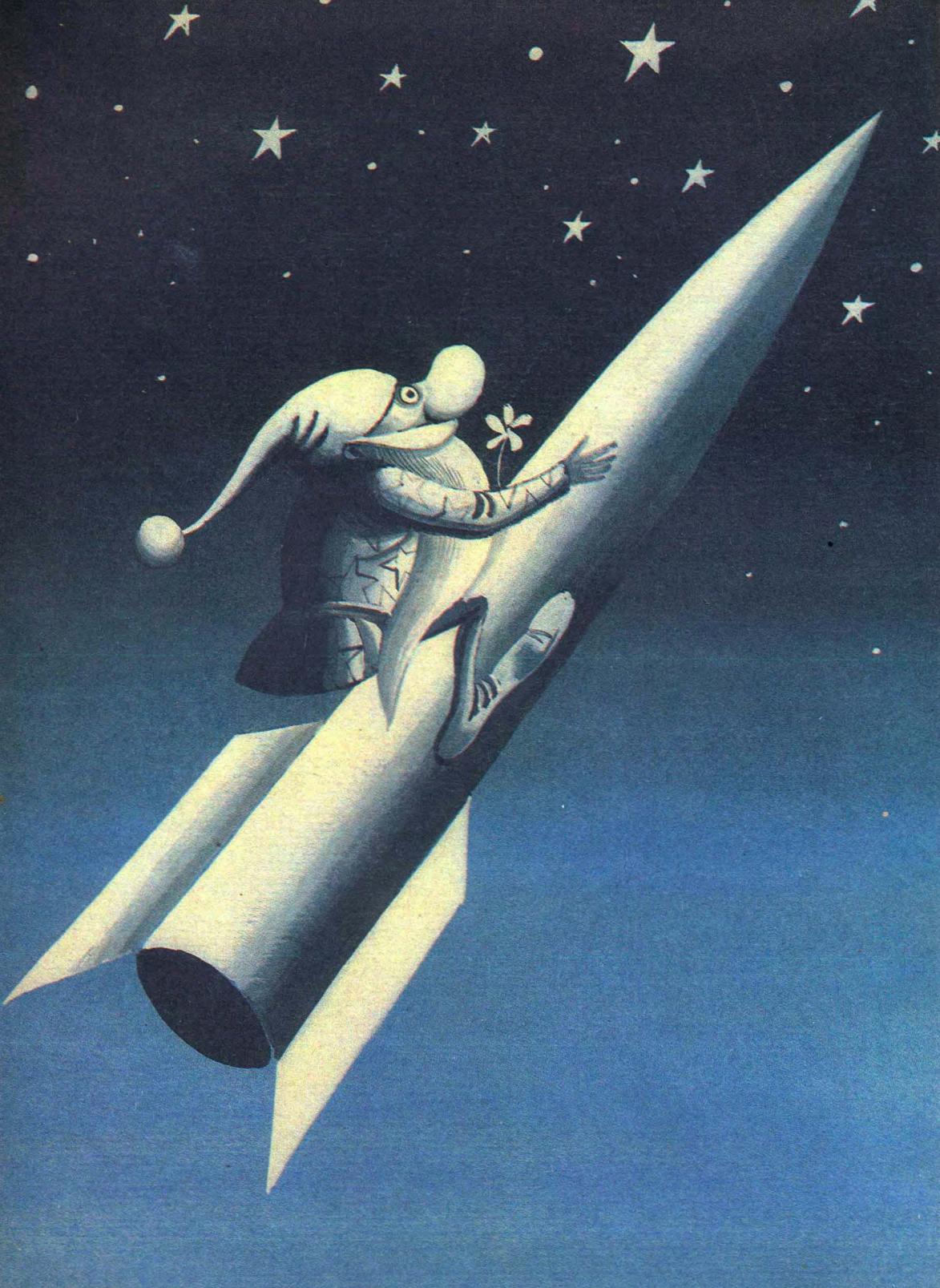
Yefrem Levitan

**A BOOK
ABOUT STARS
AND PLANETS
TO BE READ TO CHILDREN**

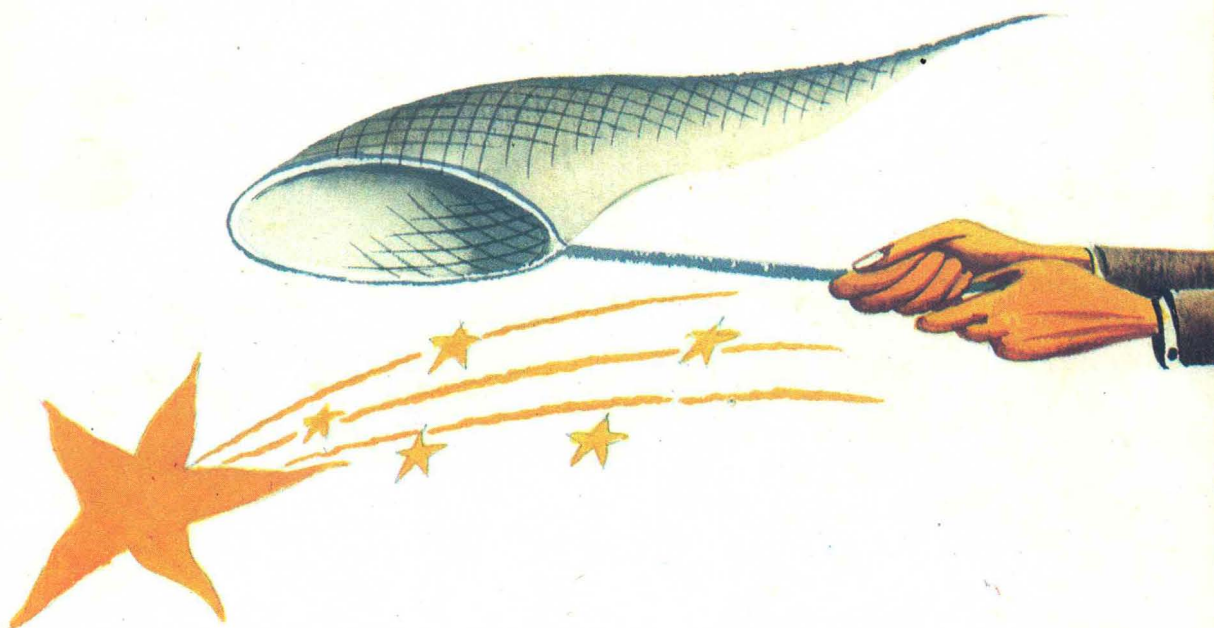








Yefrem Levitan
***A BOOK
ABOUT STARS
AND PLANETS
TO BE READ TO CHILDREN***



Raduga Publishers
Moscow

Drawings by *Sergei Alimov*

Translated from the Russian by *Sergei Sosinsky*

English translation © Raduga Publishers 1986.
Illustrated

Е. Левитан

МАЛЫШАМ О ЗВЕЗДАХ И ПЛАНЕТАХ

На английском языке



*Printed in the Union of Soviet Socialist
Republics*

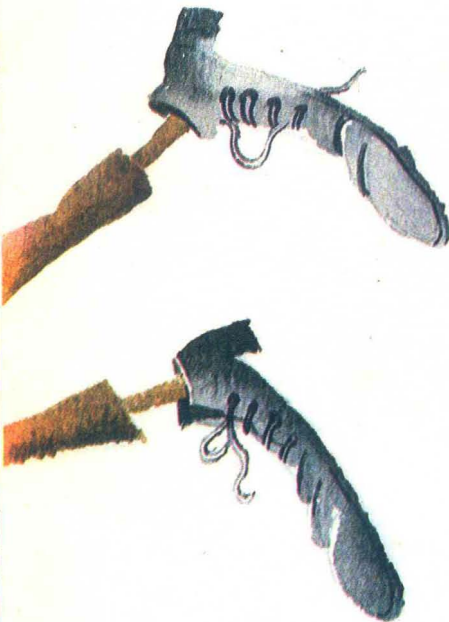
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ISBN 5—05—000666—X

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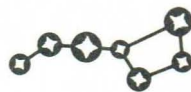
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Dear Parents

This book will help you give 6- to 8-year-olds an idea of one of the most thrilling sciences, astronomy. A knowledge of astronomy is very useful for children because first, it plays an important part in forming a wide view of the world; second, the study of astronomy develops in children the power of observation and the ability to make deductions from their observations; and third, a child interested in astronomy will study nature, geography, mathematics, physics, chemistry and his or her other school subjects with greater interest.

Can pre-school children understand the elementary scientific information explained in this book? Modern educational sciences and psychology have reached the conclusion that a child's intellectual potential is much higher than was formerly believed. Scientists believe that it is possible for pre-school children to develop not only visual image thinking but also, to some extent, abstract thinking.

That is why books on mathematics, physics and biology have appeared on children's book shelves next to the familiar fairy tales and story-books. This book is about astronomy.

It is not enough just to read it. The reading must be supplemented by observations, experiments and discussion of what has been observed and read. Children will not be able to understand the material contained in this book without working on it with their parents.

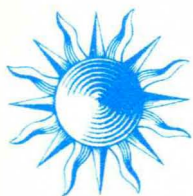
Before reading the book to children, please look through it yourself, paying particular attention to the instructions at the beginning of each section.

The book has many illustrations which when being examined together with a child will enlarge

and deepen the knowledge gained in reading. A child's attention to begin with will be drawn to the large colour pictures. You can use these to discuss what has been read, or even suggest that the child make up his own stories about the pictures. The documentary photographs, engravings and drawings in the margins will help you to explain the astronomical concepts and phenomena to the child more easily and graphically.

After reading each story with the children, find out what they have understood and remembered, if the material has proved difficult for them, read it once again and look at the illustrations.

Our purpose will have been attained if our readers and listeners become interested in astronomy and will want to learn as much as possible about the stars and planets.

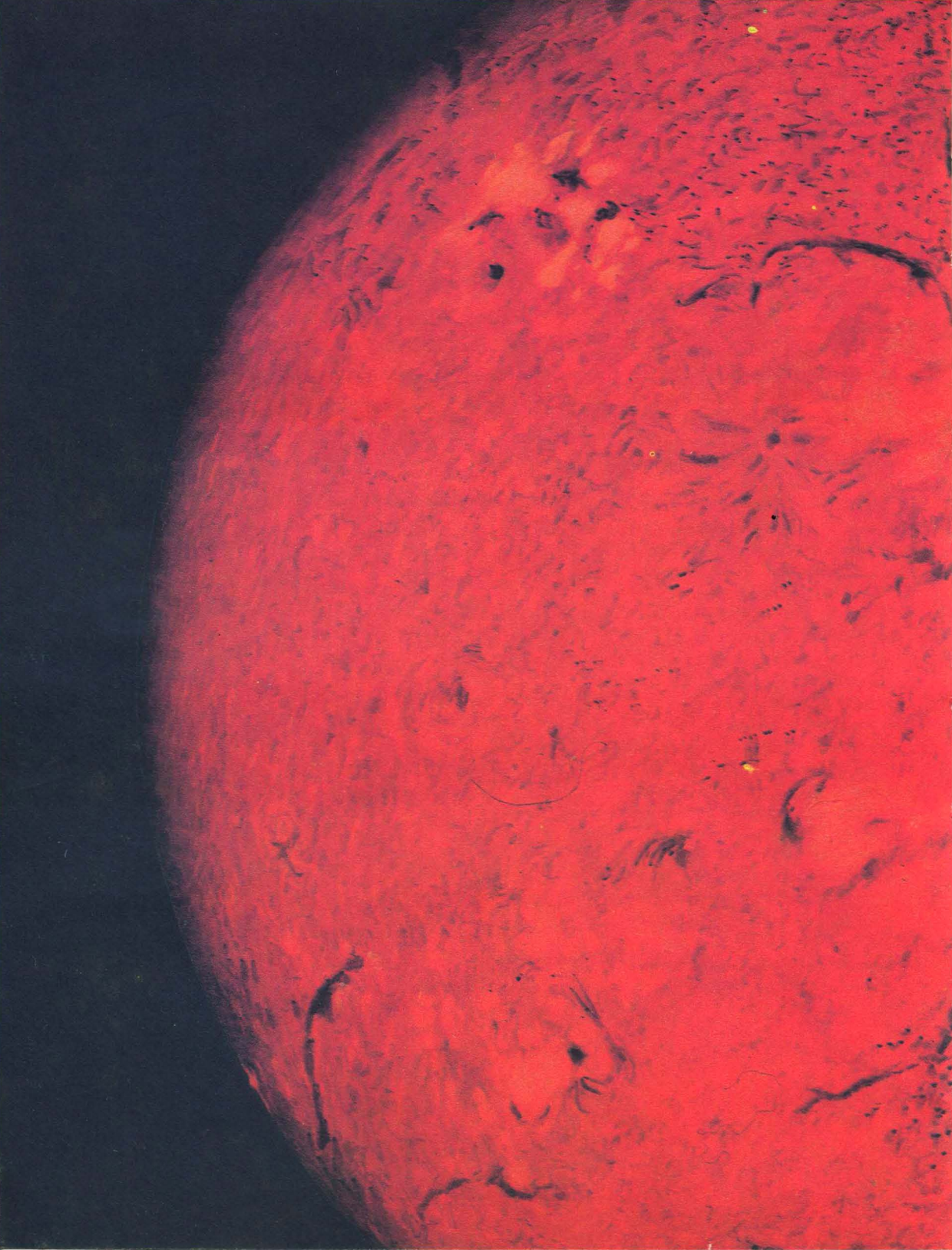


THE SUN

Your children will begin to learn astronomy with the Sun. It is one of the first objects of inanimate nature which the child notices, and is the nearest star to us.

The purpose of the first section is to provide children with an elementary knowledge of the shape and size of the Sun, the distance to it, and the use of solar energy. These are quite complicated questions for pre-school children, so do not attempt to read and explain several stories at a time. Try to carry out the observations and experiments described with the children, and by all means discuss the results. Before beginning your observations of the Sun, make protective sunglasses and explain to the children that they should not look at a bright Sun without them, and even through the glasses, they should not stare continuously at it for more than one or two minutes. The glasses may be made in different ways, and perhaps the ones you make will be more convenient than those described in the book. The important thing is for the glasses to fit exactly so as to protect the eye reliably from direct sunlight. Only then will your child's eyesight not be harmed by the observation of the Sun.





Sveta and Alex like a good fairy tale. Their Father often tells them about Little Red Riding Hood, Pinocchio, Karlsson, Winnie-the-Pooh and Brother Rabbit.

One night, the children asked their Father to tell them a new story. How do stories usually begin? Once upon a time... or Long, long, ago... But this time Father began in a different way.

"Yesterday I had a visit from an old friend of mine, a dwarf named Doc. I was very glad to see him and asked him to sit next to the clock on my desk."

"Dad, did a real live dwarf really visit you?" Alex interrupted the story.

Sveta laughed looking at her surprised younger brother, but her Father was quite serious.

"Of course he did," said Father. "My friend Doc visits me very often."

Sveta stopped laughing and Alex crawled out from under the blanket and looked at his Father with his eyes wide open.

"What's he like?"

"He's blue," answered Father. "He wears a blue suit covered with stars and has a magic Sun wand in his hands, a gift from the Dwarf Magician."

"A magician!" Alex shouted.

"Of course. Doc lives in the fairytale kingdom of dwarfs. The chief dwarf is called the Magician and Doc is his favourite pupil. Doc's very clever, curious and kind and was given his magic wand for knowing a lot and being able to do many things."

Their Father fell silent. The children were also quiet.

"Why does Doc have stars on his suit and a

The Appearance of a Dwarf Astronomer

The way scientists see our Sun

Astronomy is a science about the Universe. It arose in ancient times when people learned to determine the time of day and find their bearings on land and sea by the Sun and by the stars



How Alex Decided to Become an Astronomer

This was how the Sun was
observed in the past



Sun wand in his hands?" asked Alex.

"Doc likes astronomy very much and astronomy is a science about the Sun and the stars. No one in the dwarf kingdom knows about astronomy better than Doc! He's a real dwarf astronomer!" answered their Father.

"I want to know about the Sun and the stars as well!" said Alex.

In the evening, the youngsters waited impatiently for their Father. When he came, Alex shouted out:

"I didn't tell anyone your secret!"

"What secret?" asked Father.

"About Doc, of course!" Alex said. "Sveta and I talked about him all the time, and I watched the Sun too."

"How?"

"I noticed when it hid behind a cloud."

"Very good!" said Father. "You looked at and observed the Sun today for the first time. Observations are very important in any science, particularly in astronomy."

"I want to know about astronomy just like Doc does," said Alex.

"That's fine. If you really do, you'll have to start to do some work!"

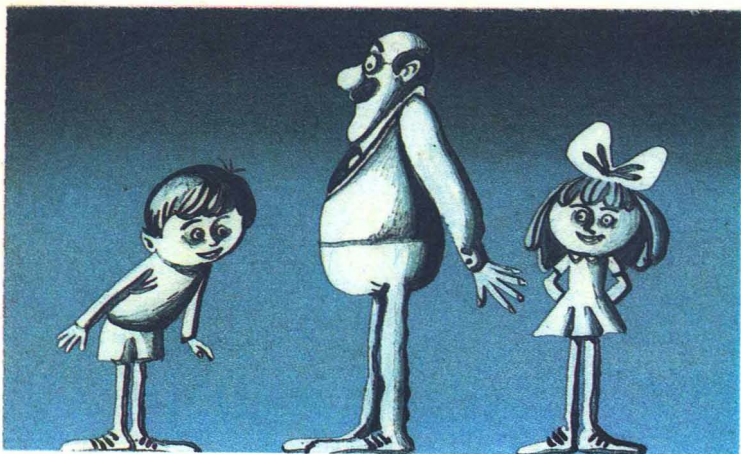
"What work?" Sveta asked.

"Work on astronomy," Father answered. "Now you already know that this work starts with observations, so carry on looking at the Sun. I'm going to give you a task to fulfill which might take a long time. You may not be able to do anything tomorrow."

"Why won't we if we try?"

"Of course you have to try, but sometimes





that's not enough.

The children began to think.

"Ah, I've got it. If it rains tomorrow, we won't be able to see the Sun," said Sveta.

"Now we've learned something very important," said Father. "It's impossible to make astronomical observations in bad weather because the clouds get in the way."

"How do they get in the way?" asked Alex.

"It's very simple. Let me stand between you and Sveta. Tell me what she's doing now?"

"I can't see," answered the boy.

"Why not?" asked Father.

"Because I can't see Sveta behind you."

"That's right. In the same way, you can't see the Sun, the Moon and the stars behind the clouds. Do you understand?"

"Yes, I do," answered Alex.

"Then think about another question. Which is nearer to us, the clouds or the Sun?"

Sveta knew the answer right away, but Alex had to think about it.

Father asked Alex another question:

"When you couldn't see Sveta behind me, who



was closer to you and who was further away?"

Alex then realised that Father was closer.

"I see," he said. "Since we can't see the Sun behind the clouds, they're closer to us."

"That's what I wanted to say, too," Sveta put in.

"Well now," said Father, "we've talked about some important things today and now it's time to go to sleep. We'll carry on another time."

"You've forgotten about our task," said Sveta.

"Don't worry," Father calmed Sveta. "First I have to make something for you."

"What do you think Father wanted to make for us?" Sveta asked her brother when they returned from the kindergarten the next day.

"He wanted to make us a present," Alex answered without a moment's thought.

"Maybe it's a present, but what could it be?"

At that point Father came in, and the children rushed to greet him.

"Do you have it?"

"Yes," answered Father. "Doc sends you a present. Now listen to me. Put your arms by your sides. Close your eyes. Now open them!"

"We can't see anything," said the children. "We've got black masks on our eyes."

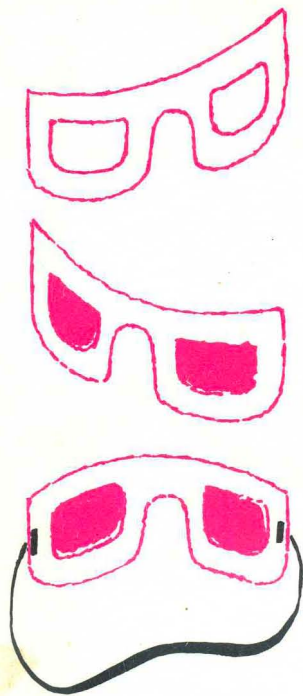
"They're not masks. Doc has sent you some sunglasses as a gift."

Father quickly removed the glasses, and the children saw Doc's presents: two pieces of dark film had been inserted into a cardboard frame. And the glasses were held on the children's eyes by rubber bands.

"What kind of gift is that? I could've made it myself," said Alex.

Sunglasses





"That's wonderful," Father beamed. "How would you make such glasses?"

"I would make them out of cardboard and a rubber band," Alex answered, "only I don't have any film."

"Don't worry," Father said. "We have lots of film."

He took out a box containing old film, produced several rolls and chose those which had very dark ends (Father said they were exposed). Then he took the scissors, cut off a few dark pieces and handed them to the children.

"These are the 'lenses' for sunglasses which you can make yourselves."

"Why make them, if we've already got glasses?"

"Maybe your friends in the kindergarten would like to have some glasses too."

"They won't want them," Alex said. "What kind of glasses are they, if you can't see anything."

"You can't see anything in the room," Father said. "But these are sunglasses, they're made so you can look at the Sun."

"Why are they so dark?"

"I know," said Sveta, "because the Sun's so bright."

"That's right," Father agreed. "The Sun is very bright, particularly in the daytime, when it's high in the sky. You should never look at such a Sun with the naked eye. Remember that rule and always obey it, then you will not harm your eyesight. **But you must not look at the Sun for a long time even in sunglasses.** Now for your first task, look at the Sun and then tell me what it's like."

In the evening, Alex told his Father how Sveta and he had observed the Sun and how the children in the kindergarten had also looked at the Sun through sunglasses.

"What did you notice when you looked at the Sun? What did you remember best of all?"

"The Sun's round," said Sveta.

"It's just like a circle," Alex supported her.

"Well, the Sun is really round," said Father.

"But is it a circle?"

"Yes, it's a circle," Alex hurriedly replied.

"Why do you think so?" asked Father.

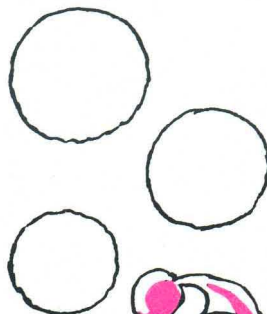
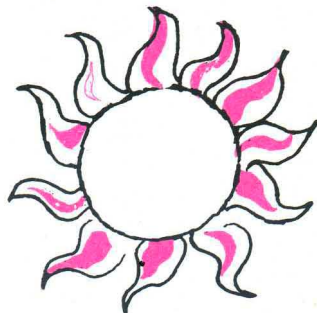
"Because it's round."

"All right, do you have anything round among your toys?" asked Father.

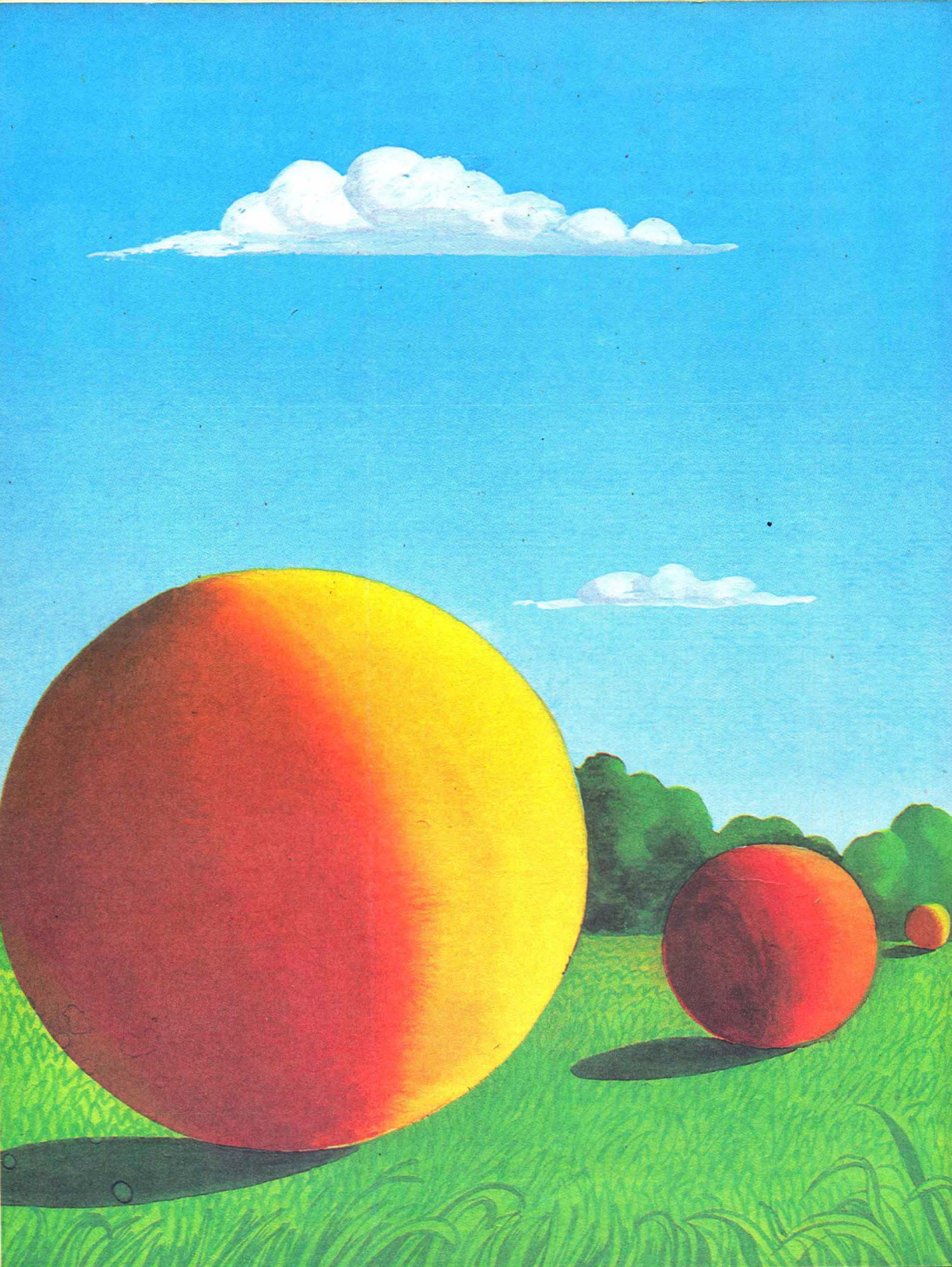
"Of course I do," answered Alex. "We've got big balls and little ones."

"Please bring them here," Father told Alex.

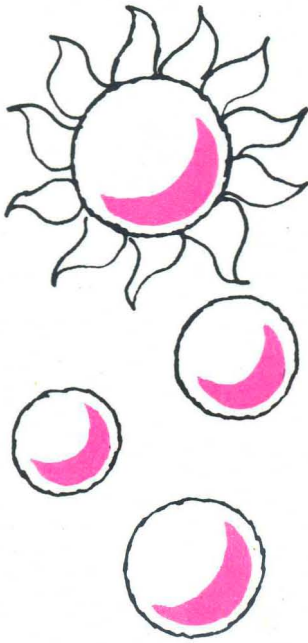
A Circle or a Ball?



The Sun is a hot sphere







"And Sveta, give me the scissors and a piece of cardboard."

Their Father drew several circles of different sizes using a drawing compass and carefully cut them out. "Now let's compare these circles with the balls. Do they look the same?"

"Very much," said Alex.

"That's right," Father agreed. "Where are they the same and where do they differ?"

"They're round, but the ball is fat, while the circle isn't," said Alex.

Father and Sveta laughed.

"You know, Sveta, Alex is actually right. Only we say that a ball is three-dimensional and not fat, while a circle is flat. Do you know what we call the figure we cut out of cardboard?"

"It's a circle," said Sveta.

"Yes, and is a ball also a circle?"

"No, it isn't!" shouted Alex. "A ball is round, but it's not a circle."

"Exactly right," Father said. "A ball is a sphere, and the Sun is also a sphere. Scientists have known that for a long time."

Doc's Unusual Friend

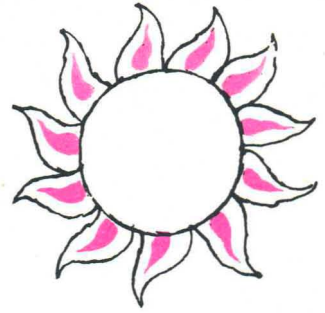
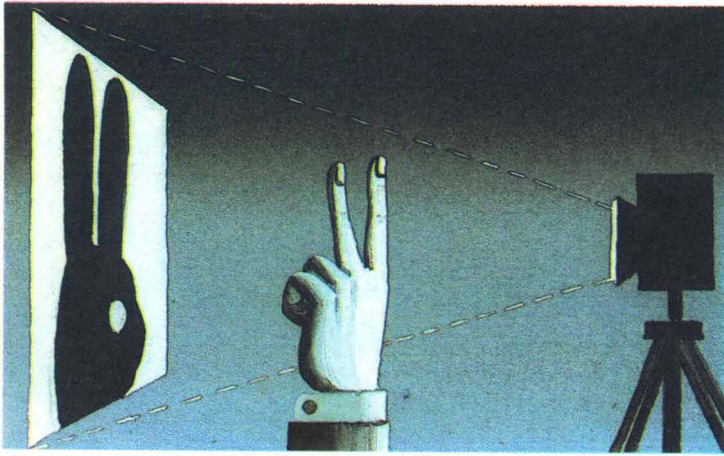
"Sveta! Come here quickly! Father's going to show us some slides!" Alex shouted out to his sister.

"Today, I must carry out Doc's request," Father said to the children. "I told him how you looked at the Sun, and Doc said that before you make any more observations you must meet Ray, who is Doc's best friend."

"Will Ray visit us?" asked Alex.

"Of course he will," said Father. "Sveta, switch on the slide projector."

The lamp of the projector lit up, but there



was no picture on the screen, only a blank bright screen.

"There's not much there," the children thought.

"Ray is here already," said Father. "See how he goes from the projector to the screen."

"We always see him in the cinema," said Sveta.

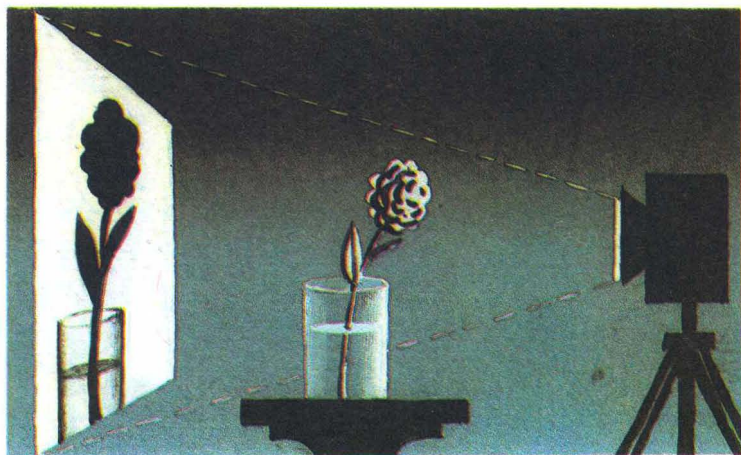
"But in the cinema it's interesting, we've only got light here," said Alex disappointed.

"It's all we need, a simple ray of light. We're going to experiment with it. The first experiment is a hand on the screen." With these words their Father raised his hand and put it into the ray of light from the projector. A hand also appeared on the screen. It was enormous and black, but it was not just a hand but the shadow of a hand.

"Now we're going to have a theatre of shadows," said Father. "I'll be the first to perform with my birds and animals."

Before the children could say Jack Robinson, they saw a hare, a kitten, a swan and other animal shadows on the screen.

"Why do shadows appear on the screen?"



"The projector does it," said Sveta.

"And so do our hands," said Alex.

"For a shadow to appear you need light and an object, is that right?"

"Of course it is," the children answered.

"Can you take any object?" asked Father.

"Yes," Alex hurried to answer. And shadows from different objects appeared on the screen (a ball, a pencil, and a toy car).

"Look," said Father, "I've taken an object and put it between the projector and the screen, but there's no shadow!"

"It's not an object, it's an ordinary piece of glass," Alex laughed.

"Isn't it an object?"

"Yes, it's an object," said Sveta.

"How does this object differ from the toys?" Father asked Alex.

"It's thin," said Alex.

"So what? I can take a piece of paper and as you see it gives a fine shadow. Paper is even thinner than glass, so why does it make a shadow?"

"You can see everything through the glass, but you can't see anything through the paper,"

Sveta said.

"That's right," Father agreed. "Remember, a shadow appears when light falls on an opaque object that is an object you can't see through. It happens because rays of light cannot pass through the object."

"Why?" Alex was unsure.

"It's very simple," said Father. "Imagine that you're riding a bicycle, then, all of a sudden, you see a tree ahead, would you ride at the tree?"

"Of course not!" Alex laughed.

"What would you do?"

"I'd ride around it."

"That's right," said Father. "You can turn, but Ray can't. He can move only straight ahead without turning, and that's why a shadow appears. If Ray was able to go around an object, there'd be no shadow."

"Does Ray go fast?" asked Sveta.

"He goes very, very fast," Father answered. "Faster than the fastest train."

"Faster than a plane?" Alex didn't quite believe that.

"Faster than a space rocket?" Sveta asked.

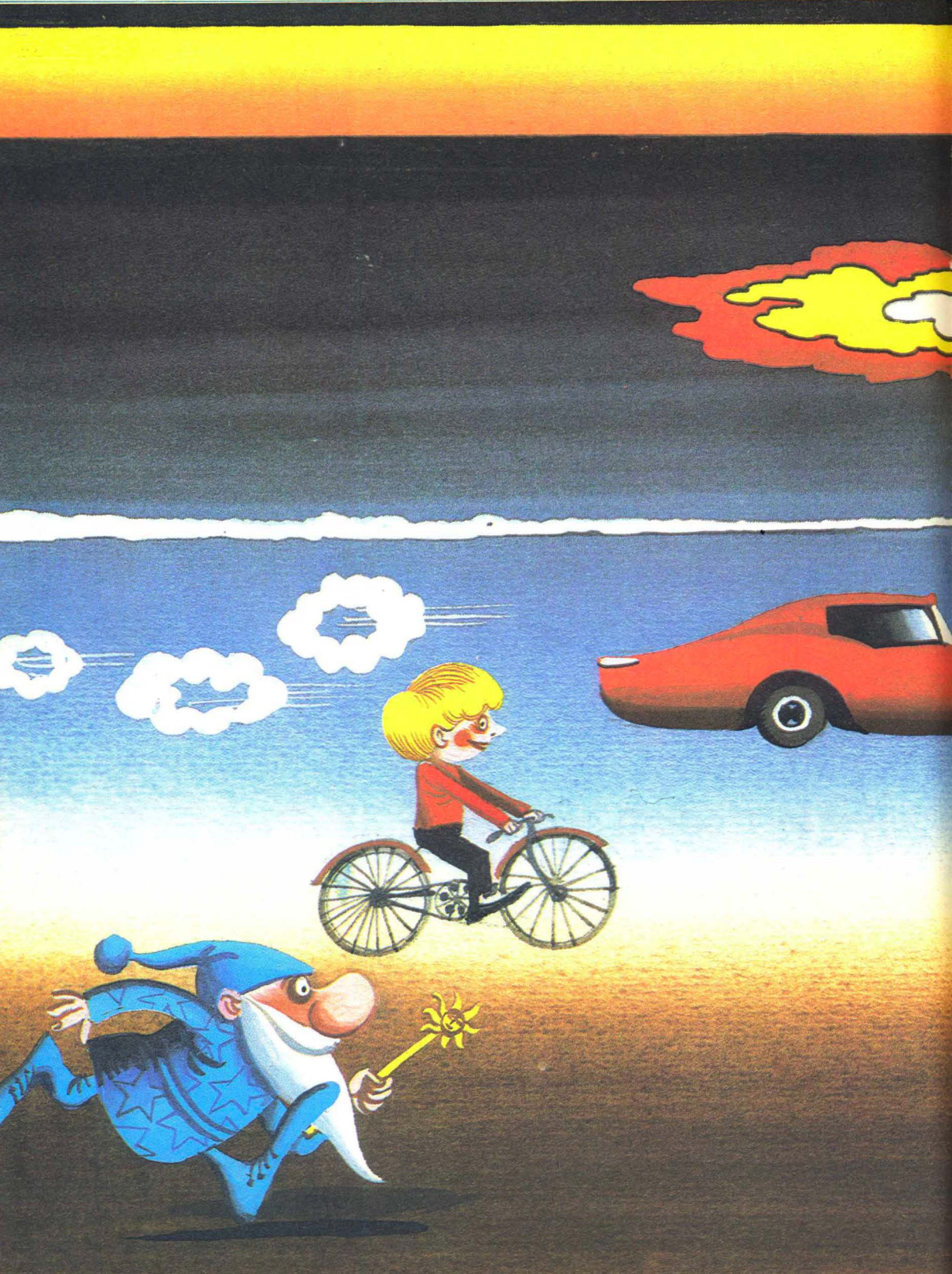
"Yes, Ray moves faster than anything else in the world," said Father. "It takes no time at all for Ray to go from Moscow to New York. He'll be there before you've blinked."

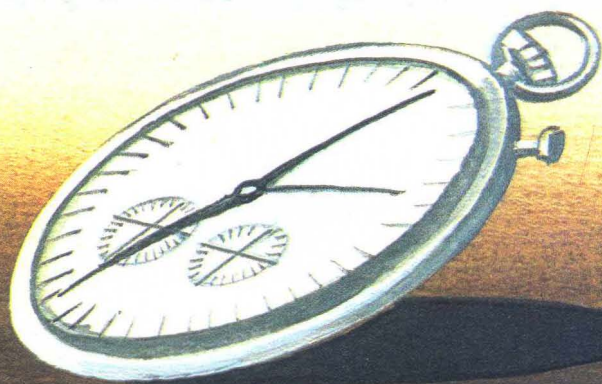
"Wow, that's something!" Alex said in admiration.

"Ray is awfully fast," said Sveta. "Only I can't understand why Doc decided to tell us about Ray. We wanted to learn everything about the Sun."

"We need Ray to learn more about the Sun," answered Father. "The Sun shines and sends out





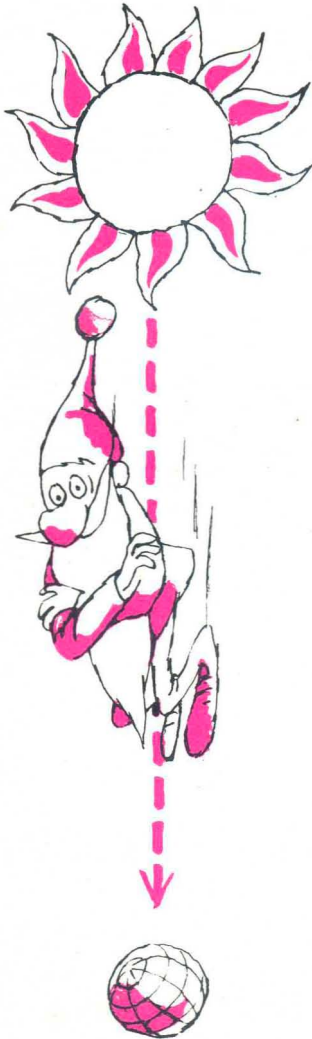


rays, and these rays can tell scientists a lot about the Sun."

"Can we learn something from Ray?" asked Sveta.

"I should think so," Father smiled, "but that's for the next time."

How Far Away Is the Sun?



In the kindergarten, the children played ball, jumped about and raced with each other. At home Sveta and Alex remembered who had run the fastest.

Father listened to the children and then asked: "Who ran faster than you?"

"Lenny," answered Alex. "He runs very fast, but I would've gone faster than him if I was on a bike."

"I would've gone faster than everyone on a bike," said Sveta.

"Why?" asked Father.

"Because a bike goes faster than a person," replied Alex.

"And what's faster than a bike?"

"A motorbike!"

"And what's faster than a motorbike?"

"The fastest racing car."

"And what's faster than such a car?"

"A plane!"

"What's faster than a plane?"

"A rocket."

"What's faster than a rocket?"

Alex was at a loss.

"So you've forgotten?" Father was disappointed.

"I remember," Sveta clapped her hands. "Ray's faster than anything else."

"Wouldn't it be fun to race Lenny sitting on

Ray!" Alex said wishfully.

"You're a daydreamer," said Father. "Ray wouldn't be interested in such distances."

"What distances?" Alex wanted to know.

"When you raced each other, each of you ran a few metres, that was your distance. Ray likes to run enormous distances."

"From Moscow to Leningrad?" Alex asked.

"No, much further," answered Father.

"From here to America?" guessed Sveta.

"Even such a long distance is nothing for Ray, but he'd gladly run from the Sun to the Earth."

"Is the Sun very far away?" asked Sveta.

"Yes, it's very far," said Father.

"Pa, could a hiker walk to the Sun?" asked Alex.

"Of course there are no pavements or motorways in outer space," answered Father. "And the distance to the Sun is very, very long. A hiker would have to walk for about three and a half thousand years."

The children gasped.

"A traveller in a car would probably reach the Sun in his lifetime though, wouldn't he?" Sveta asked.

Father wrote down some figures, and then said:

"He'd have to drive for about two hundred years and as a person lives an average of seventy years, would he manage to reach the Sun?"

"No, he wouldn't," said Sveta who knew that seventy was less than two hundred.

"How long would it take in a plane?" Alex asked.





"I'll work that out in a jiffy," said Father. "It would take almost twenty years in a jet plane. What do you say now, is the Sun far away?"

"Yes, it's very far away," answered Alex. "If an astronaut flew to the Sun in a rocket, how much time would it take?"

Father did some sums and answered,

"Only a few months."

"How long did it take Ray to reach us from the Sun?" Alex asked.

"He doesn't need much time. Ray's so fast that he travels from the Sun to the Earth in about 8 minutes."

"Wow!" Alex said in admiration. "He's some fellow, that Ray."

"Pa, last time you said Ray would tell us something about the Sun?" Sveta remembered.

"He already has," answered Father. "With his help we have learned that the Sun is very, very far away. Even Ray who is very fast takes 8 minutes to travel from the Sun to the Earth. Scientists have worked out that Ray flies one hundred fifty million kilometres in that time. Ray also told us that it's very hot on the Sun and the Sun is an extremely hot sphere."

"I don't understand how Ray told us that," Alex said thoughtfully.

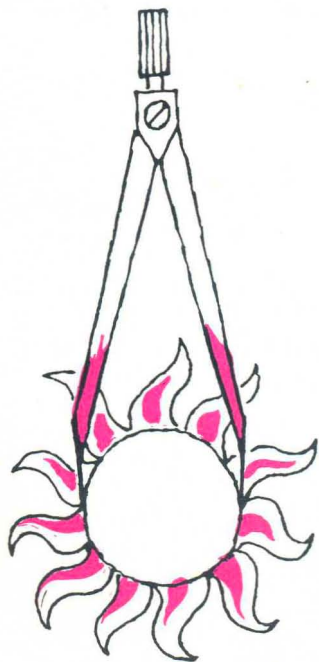
"Remember how we enjoyed sunbathing on the beach, were your backs warm in the rays of the sun?"

"I was hot!" said Alex.

"You see. The rays travelled an enormous distance from the Sun but they still warmed us. That means it's very hot in the place where they came from."



Is the Sun Big or Little?



"It's Sunday tomorrow," said Father. "Let's go to the river."

"Hurrah!" Alex was overjoyed. "We'll go swimming! I hope the weather's good!"

They were lucky, it was an excellent day. The children went swimming and raced with each other. Planes flew above in the blue sky. The children watched with interest how a tiny plane would appear in the distance and then grow bigger before their very eyes and how a big plane became smaller and smaller as it flew off.

"Pa, do the people in the plane also become smaller?" asked Alex.

"No, they don't. They're the same in the plane as they are here on Earth," answered Father.

"That means the plane in the sky is the same size as it is here on Earth," Alex said, "it only seems to us that the plane is smaller, right?"

"Yes, it only seems smaller," Father agreed. "Any object, even the biggest one, seems small at a long distance from us. The further away it is, the smaller it seems. Do you see?"

"Yes," the children answered.

"Then let's look at the Sun. Only don't forget about the sunglasses."

"Oh, it's as small as a soccer ball," Alex said.

"It only seems small, because actually it's very, very far away," said Sveta.

"How big is it really?" asked Alex.

"Actually, it's so big that all objects on earth seem tiny next to the Sun. **The Sun is not only a very hot sphere, it's also a giant sphere,**" answered Father.

"A giant sphere," Alex murmured thoughtfully. He put on his sunglasses again and looked at the far-off Sun.

One evening Father said,

"Doc the dwarf came to see me again today. He asked me whether you were still studying astronomy."

"Of course we are," the children answered in a chorus.

"We watch the Sun every day," added Sveta.

"When do you watch it?"

"In the morning when we go to the kindergarten, in the afternoon before lunch, and in the evening."

"Excellent!" said Father. "Doc will be glad to hear that, he wanted you to observe the Sun several times a day."

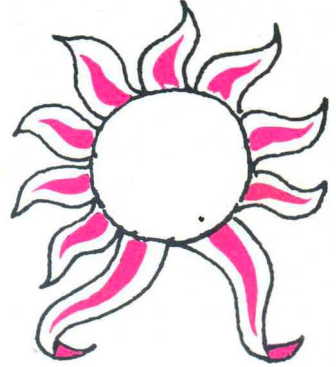
"Why?" asked Alex.

"Doc wants you to watch how the Sun travels through the sky."

"How can we see that?" wondered Sveta.

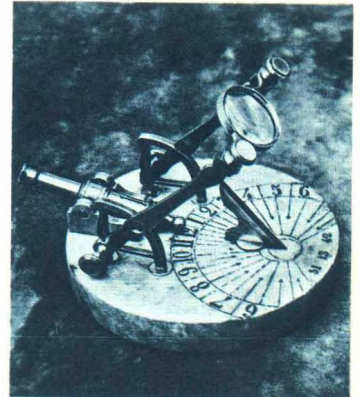
"Look at the Sun at different times of the day,

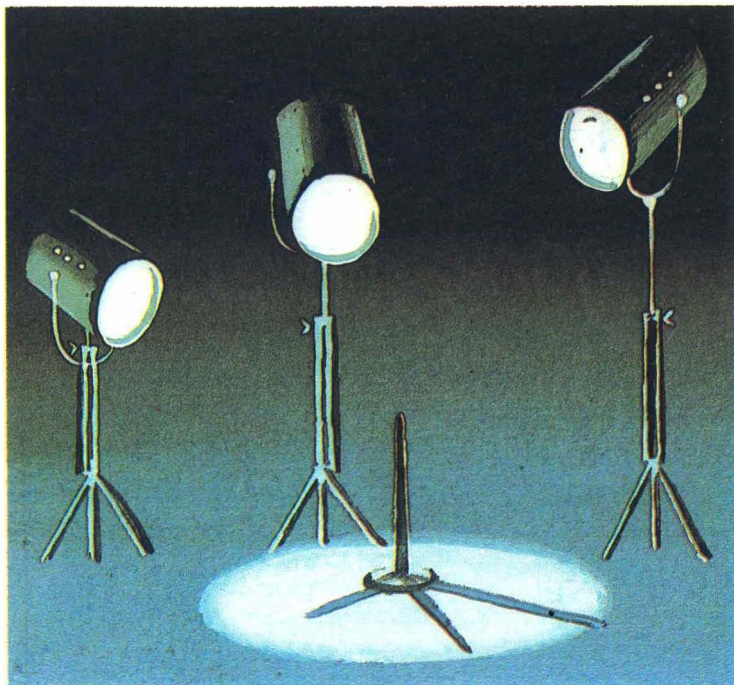
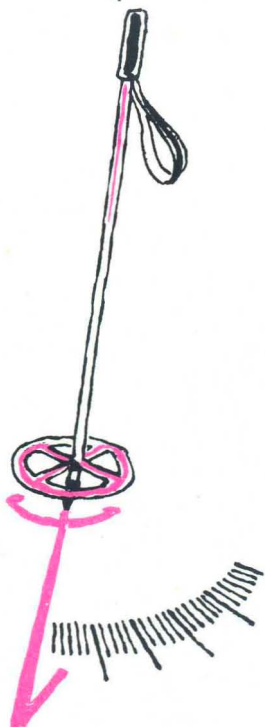
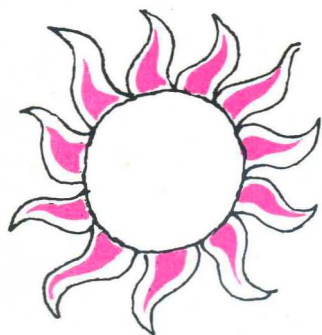
How the Sun Travels Through the Sky



This cannon would fire by itself at noon

A cannon shot sounded at noon





in the morning, afternoon and evening; and remember where it was each time and how its position in the sky changed. The most important thing is to watch the Sun from one place. Do you understand?"

"Is that all?" Alex was disappointed. "I've already noticed that in the morning when we go to the kindergarten the Sun is over the birch tree, in the afternoon it's above the next tall building, and in the evening it goes down behind the garage."

"Don't think it's all that simple," said Father. "If you really want to know something, you should make sure for yourself that it's really so."

"How can we make sure the Sun travels through the sky?" asked Alex.

"We need a gnomon, an instrument used by old astronomers."

"Where can we get one?" it was Sveta's turn to be disappointed.

"You can make one yourself. Take a stick, a ski stick, for instance, find an even spot in the yard from where it's easy to observe the Sun, insert the sharp end of the stick into the ground, and your gnomon's ready."

"How do you use it?" the children wanted to know.

"You must look at the shadow cast by the stick in the Sun."

"Why should we look at a shadow?" asked Alex.

"Wait, you'll understand everything in a minute. Bring your old toy pyramid here and remove all the rings from it. See, you get a rod on a little stand. Now let's switch off the top lights, turn on the desk lamp and place it so the rod is lit up and casts a shadow."

"There's really a shadow!" cried out Alex.

"Put a ring where the shadow ends," said Father, "and watch closely how the shadow changes."

"I've raised the lamp."

"The shadow's smaller," said Sveta.

"Where is the lamp now?"

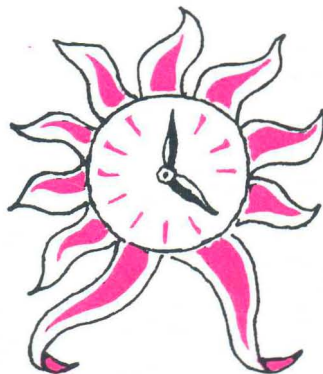
"It's high up," answered Alex, "you've lifted the lamp." Then Father changed the position of the lamp several times, raising it and lowering it, and the children saw the shadow grow longer and shorter in turn.

Then Father began to move the lamp in his outstretched hand, and the children saw the shadow move.

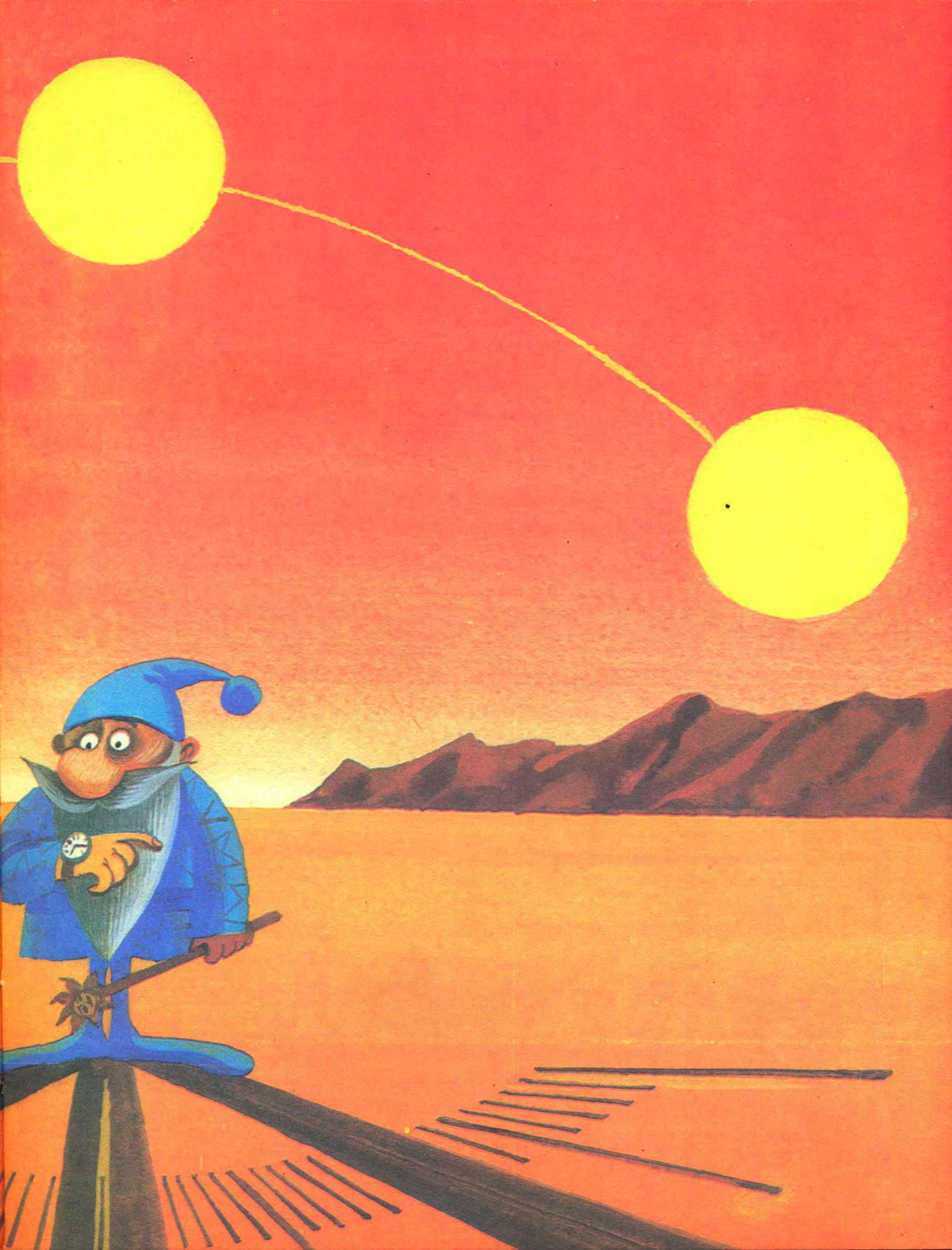
"Then the shadow of the stick lit up by the sun must also change," Sveta said.



Sometimes travellers found out the time with the help of the noonday Sun









The mass of the Sun is nearly
330,000 times greater than the
Earth's

"Of course it'll change. To see for yourselves, look at the Sun tomorrow in the morning, afternoon and evening at a chosen spot and trace the shadow cast by the stick each time."

"How can we trace it?" Alex asked.

"Look," said Sveta. She put the desk gnomon on a piece of paper and drew a line where the shadow was.

"Good girl," Father praised her. "It's not an easy task. Try to do it well."

As soon as there was a sunny day, the children set about doing the job.

First they chose an even spot in the yard of the kindergarten and thrust a ski stick into the ground in the middle of it. Now they had a gnomon. Sveta traced a line in the sand along the shadow of the stick, while Alex marked the end of the shadow by a stone so everyone could see where the shadow ended. The children looked at the Sun again before lunch and Alex traced a new line in the sand and put a stone at the end. In the evening the work was successfully finished. There were three lines coming from the ski stick like a fan, two long ones and one short one. The short shadow had been traced at about noon when the Sun was the highest in the sky.

In the evening the children interrupted each other telling their Father how they had observed the Sun's movement.

"Very well. Now tell me, why were the shadows from the gnomon different?" asked Father.

"Because the Sun was not standing in one place," said Sveta quickly.

"First it was over the birch tree, at lunch time it stood over the house, and in the evening it came down low," added Alex.

"Right, you saw the Sun moving across the sky, that was what the gnomon's shadow told us."

"It doesn't know how to talk," said Alex.

"Oh yes it does," Father argued. "But the shadow doesn't speak with a voice but with its length, the sun gnomon's shadow becomes shorter when the Sun goes up, and longer when the Sun goes down. Do you see now how the shadow can speak?"

"The lecture is over. Goodbye everyone," said the guide. The lights went on in the large hall of the Moscow Planetarium. The listeners rose from their seats and began to leave. Alex, Sveta, and Father also walked out.

"Why do you think people have been interested in the Sun from olden times?" asked Father.

Sveta and Alex thought about the question.

"Could people live without the Sun?"

"No, they couldn't," answered Alex who had remembered the story about the Crocodile swallowing the Sun and how terrible life had become on Earth.

"That's right, it's impossible to live without the Sun," said Father. "Why?"

"Because it'll be cold," said Alex.

"Because it'll be dark," added Sveta.

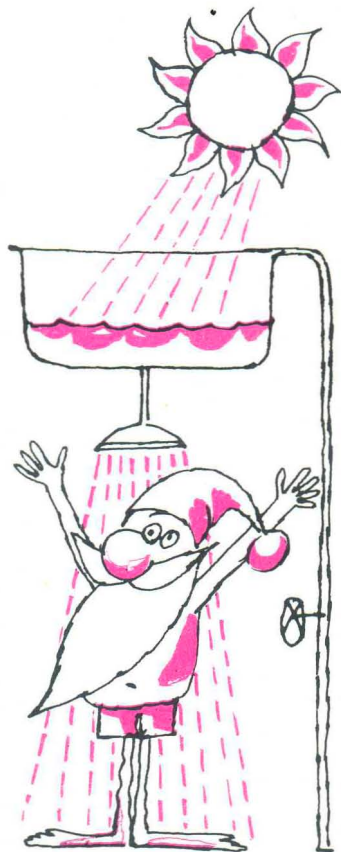
"Correct," Father said. "Now you've answered my question I'll show you the solar section of the astronomical grounds in the Moscow Planetarium."

"What does it have to do with the Sun?" Alex was surprised. "It's a shower."

"Put your hand under the flowing water."

"Oh," Sveta cried out, "it's hot!"

How the Sun Serves People



"Now let's see how it was heated. Do you see that box with a black bottom and a glass lid? There are pipes in it through which the water flows. The rays of the sun easily go through the glass and warm the water in the pipes, and the warm water is collected in the tank. That's all there is to the solar shower, many such showers have already been built."

Then Father came up to a large mirror looking like a huge plate.

"Look, what a big curved-in mirror," he said.

"It's like a projector," Alex said.

"So it is," Father agreed. "And what'll happen if Ray hits the mirror?"

"We'll get a spot of light on the wall," said Sveta remembering that the children often played with the light-spots in kindergarten.

"It'll be a lightspot if the rays are reflected from a normal mirror, but with a curved-in mirror it's much more interesting. The rays are reflected from such a mirror and they all come together."

"So what?" asked Alex.

"Since the mirror is very big, many rays come together."

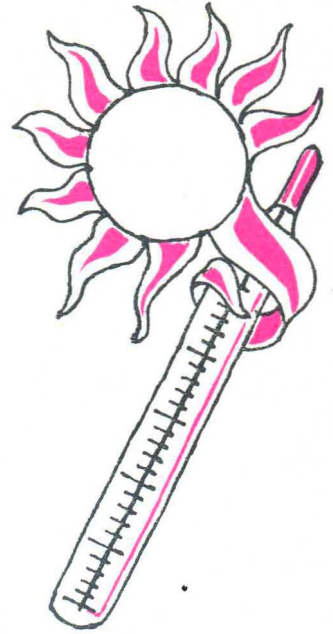
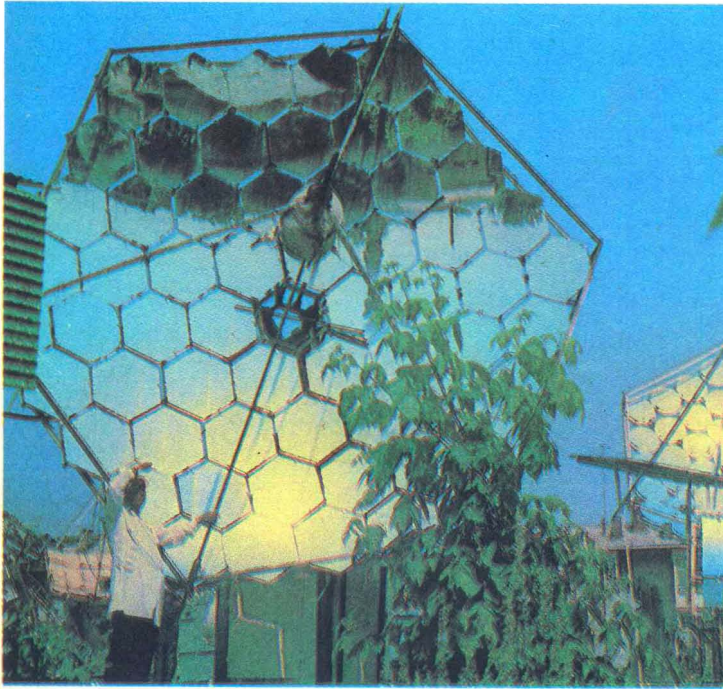
"And you get a burner," Sveta guessed.

"That's one way of putting it, yes it's a burner," Father smiled. "It can even melt metal."

At this point, a guide came up with a group of visitors, directed the lightspot from the mirror at a piece of metal, and everyone saw the metal melting.

"Now you've seen how a solar smelting oven operates," said Father. "Do you remember you asked me about the wings of the cosmic station which you saw in the planetarium?"





The temperature in the centre of the Sun is $20,000,000^{\circ}\text{C}$ and $6,000^{\circ}\text{C}$ on the surface

"You said they were solar cells," Alex remembered.

"Yes they are, and they help provide the electricity for instruments in the cosmic station."

"Where do the solar cells get the electricity from?" asked Sveta.

"What are the cells called?" Father asked.

"Solar cells," Alex said.

"There's the answer to Sveta's question, the cells turn the sun's rays into electricity. Soon, such cells will also serve people on Earth and some day, people will learn to heat and light their homes by using the Sun."

After several days Father brought the children a magazine with a handsome shiny cover and showed them one of the pictures.

"This is an enormous pyramid which people

Why People
Once Feared
the Sun



Worshipping the Sun in ancient Egypt

built a long, long time ago in honour of the Sun," said Father.

"What did they build it for?" asked Sveta.

"There was a time when people thought that the Sun was a strong, mighty god and were afraid of it," Father answered.

"Why were they afraid of it?" asked Sveta.
"The Sun is so nice. And it's so useful."

"Yes, it is," Father agreed, "but imagine that the Sun shines brightly every day, drying and scorching everything on the fields, or maybe it doesn't appear from behind the clouds for weeks, and it rains all the time. You can't gather a good harvest with such weather."

"But it's not the Sun's fault, is it?"

"Of course it isn't," replied Father. "But people believed that the Sun was punishing them and because they were afraid, they tried to please the Sun."

"How did they do that?" Alex did not understand.

"Well, for example, they built a pyramid like this one, as a gift to the Sun. The people often got together and pleaded with the Sun to show mercy on them in order to please the Sun."

"Why did they do that?" Sveta was unsure.
"The Sun can't hear them anyway."

"Of course it can't," Father agreed, "but ancient people had no idea what the Sun was and thought that if they asked it, it would show mercy to them."

"Father, what did people know about the Sun then?" asked Alex.

"Almost nothing. They didn't know that the Sun was very far from us, nor that it was an enormous hot sphere and that life was impossible on

the Sun."

"And we already know all that," Alex bragged.

"Yes you do," said Father. "Knowledge helps people in life very much."

"Doc was very angry today," Father told the children.

"Why?" Alex asked.

"He said that Dopey the dwarf made him angry," answered Father.

"And who's Dopey the dwarf?" asked Sveta.

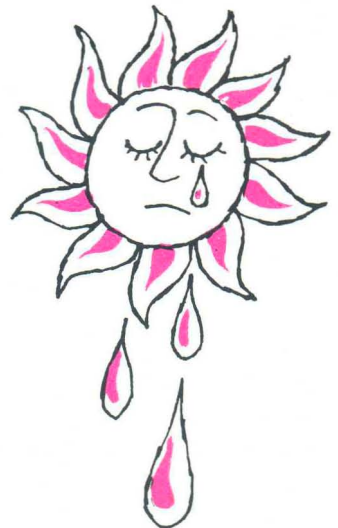
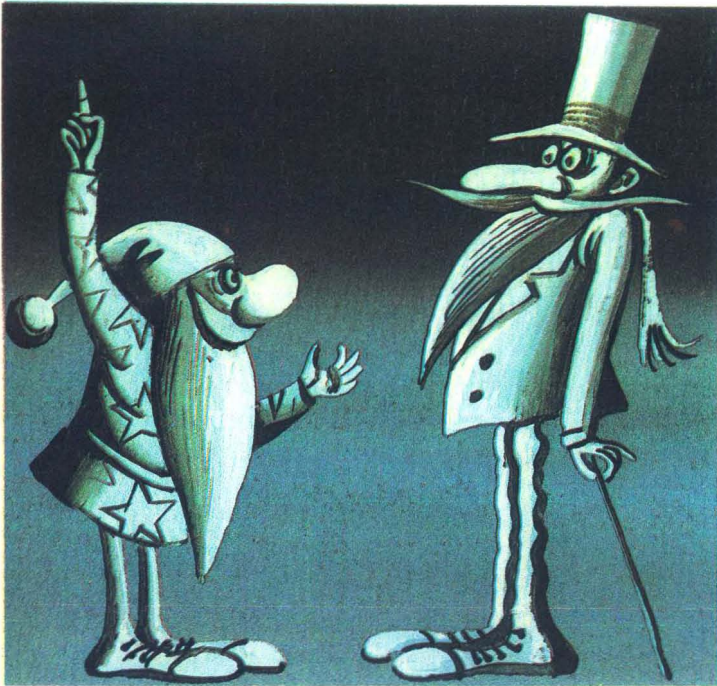
"He's a person who lives in the kingdom of dwarfs but he doesn't really know anything, and he puts on airs, talks about everything and makes out he's very clever."

"But why was Doc angry?" asked Sveta.

"It all started when Doc went to listen to what

What Dopey Knows About the Sun

The last conversation about the Sun is a kind of test to see what the children have learned. The children must find the mistakes in Dopey's story. The story should be read slowly 2-3 times and the number of mistakes the children find after each reading should be compared.





Dopey had to say to the dwarfs who go to school. Having heard what he said, Doc was furious and even his teeth ached from all the nonsense which Dopey said."

"Pa, did Doc tell you what Dopey said?" asked Sveta.

"Of course he did. Doc recorded what Dopey said and let me listen to the recording."

"Pa, please tell us about it," Alex asked.

"Why should I?" Father was surprised. "Almost everything was wrong in what Dopey said."

"We want to hear it anyway," Alex said.

Father thought for a while and then said:

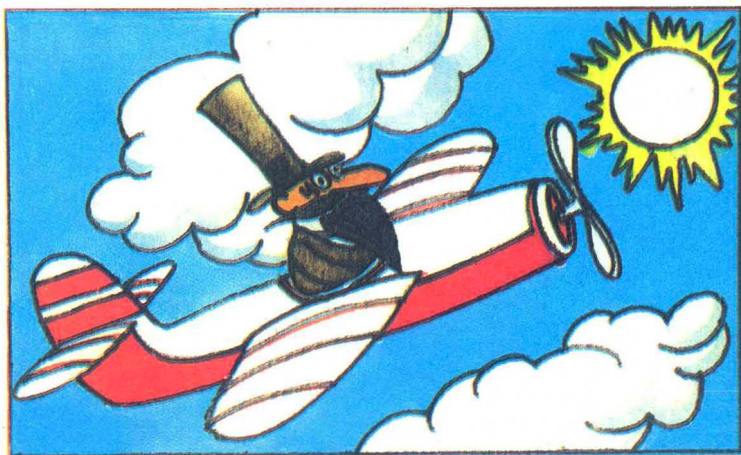
"Perhaps I'll tell you after all, but first let's agree that you'll listen very carefully to me and when you hear something wrong, you'll bend one finger, then another, then a third and so on. Sit down so you don't see each other and so don't know how many fingers each has bent. When I finish, we'll count how many mistakes you noticed. All right?"

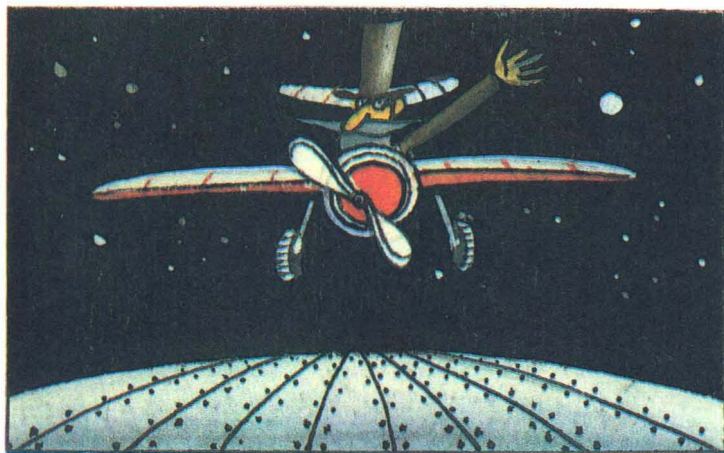
"Yes! Yes!" the children were pleased.

Father seated the children with their backs to each other and began the story.

DOPEY'S STORY

When the little dwarfs sat down at their tiny school desks, Dopey began to walk to and fro in the classroom looking very clever. Finally, Dopey spoke, "I shall tell you about a task the Magician himself gave me. He asked me to visit the Sun and to learn what is happening there. At the time, no one knew anything about the Sun, and I was to become the first great Sun scientist. I agreed, of course.

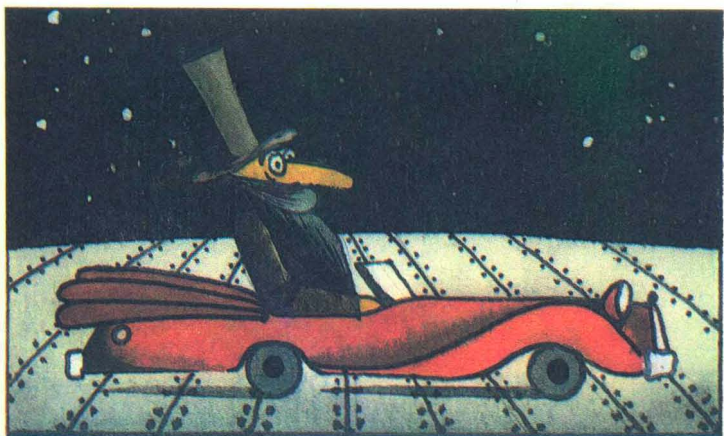




I got into a little plane which the Magician had given to me as a present and flew to the Sun. In an hour, I saw that the Sun was nearby. I'm an excellent pilot and I flew the plane very well and did not miss the little Sun, but landed easily on one of the Sun's airports.

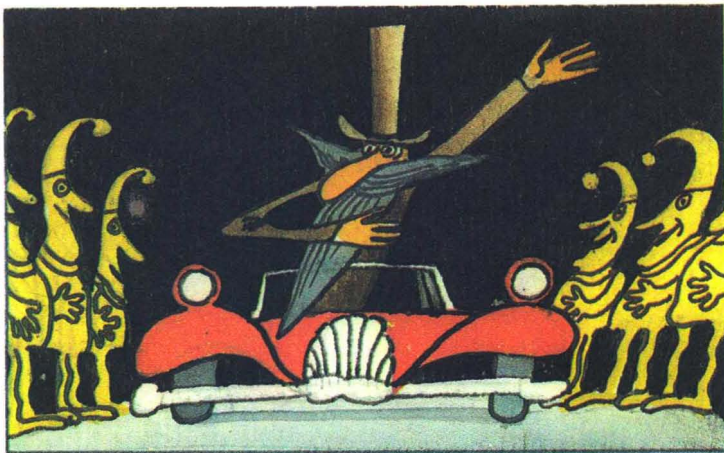


The local inhabitants, who are known as sunflowers, came to welcome me. The Sun orchestra played a ceremonial march. You should've seen those musicians, they were all very thin and bright. It turned out that the musicians were rays. I was told that they were servants of the Sun King and lived on the Sun all the time and the King never let them go.



Several minutes later a car drove up and I was asked to make a trip through the Sun. The road was wonderful and paved with iron and not with asphalt. The car drove so fast on such a road that I was even cold at times.

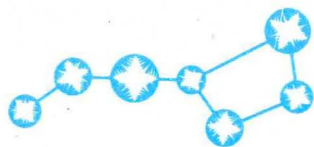
I forgot to say that the sunflowers were extremely tiny. Compared with you (who are also tiny), they are real midgets. When I told them about the Earth, they all wanted to visit us as guests and asked me to take them back to Earth.



I had to say no because there was no room in the plane. And then there had been the cold wind along the way and I had a sore throat and no one knew how to treat me so I had to return to Earth quickly."



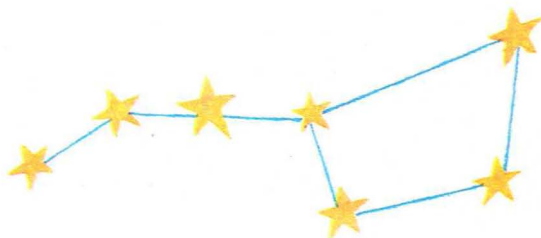
The children giggled listening to Dopey's story. They had stopped bending fingers for some time, because there turned out to be more mistakes than they had fingers on their hands.



THE STARS

This section is intended to inform children that the stars are enormous hot spheres resembling our Sun. The stars are very far from the Earth which is why they do not provide warmth and seem so small. There are very many stars in the sky, and in order to tell them apart people have united them into constellations. The most brilliant stars have names. To observe the stars in the sky, choose a place where the light from house windows and streetlamps will not get in the way.

It is not necessary for the children to be able to find all the constellations about which Father told Sveta and Alex. It is enough for your children to locate the Big Dipper and the North Star, the brightest star in the Little Dipper. But if your children like to watch the stars in the sky, make use of the recommendations and pictures in the book and point out the Cassiopeia constellation. On clear, moonless summer and autumn nights, it is easy to find the summer-autumn triangle (Vega, Deneb, and Altair) in the sky. In winter, the Orion constellation can also be seen and Taurus next to it.





"How's Doc, Pa?" asked Alex.

"Doc has only just returned from a wonderful trip to the land of a thousand suns," replied Father.

Alex listened with bated breath. To think there's a land where the sky's filled with suns.

"Lucky Doc," Sveta envied the dwarf. "I'd like to see that land too."

"We'll see it now. Let's go outside and find a place where the streetlights and windows do not get in the way."

"I can't see anything," said Alex when they had found such a place.

"Stand still and look at the sky."

Alex and Sveta looked at the stars in the sky for a long time in admiration saying:

"That's my star."

"And that's mine."

"It's time to go home," said Father.

"Home?" Alex was surprised. "But you promised to show us the land of a thousand suns."

"I've kept my promise. The stars you just saw are a thousand suns!" answered Father.

"How can there be a thousand suns when it's so dark?" said Sveta.

"Well, there are," answered Father. "The stars are simply very distant suns."

In the morning, Sveta and Alex went to the kindergarten and told the children about the land of a thousand suns which their Father had showed them.

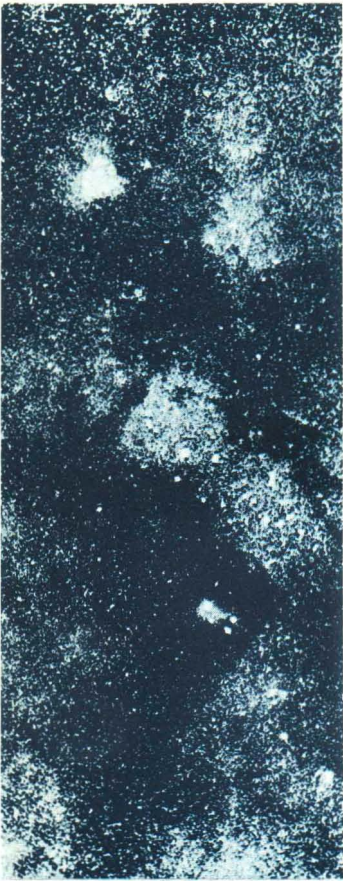
In the evening, the children went to watch the stars again. Sveta told Alex to find his yesterday's

The Land of a Thousand Suns

Astronomy studies the stars, nebulas and other astronomical objects



How Many Stars Are There in the Sky?



Part of the Milky Way magnified
many times

stars in the sky, but it was difficult to decide which star was his.

Alex said,

"There are so many stars, there's no way of telling which star is which."

"You're wrong," Father said. "People have learned how to find different stars in the sky a long time ago, we know where each star is and the brightest stars have their own names and people have even managed to count them."

"Count the stars?" Alex was uncertain. "But there are millions of them."

"Not millions," Sveta replied. "You've forgotten that Doc was in the land of a thousand suns, haven't you?"

Father added,

"The houses and trees have blocked part of the sky from us, but even so we would not have seen more than three thousand stars. Now look at the light strip which you can just see stretching through the whole sky. Have you found it?"

"Yes," the children answered.

"It's the Milky Way," said Father.

"Why is it milky?" asked Alex.

"Because it's the colour of milk. The Milky Way is made up of millions of stars that are so far from us they blend into a shiny band."

"I said there were millions of stars," Alex jumped up and down.

"Yes, there are very many stars, but we can see only about three thousand."

The Big Dipper

"How is it that people don't get all mixed up with these thousands of stars?" Alex asked his Father.

"If you look at the stars very carefully, you can see many pictures in the sky," said Father.



"Pictures?"

"Yes, pictures traced by stars."

"I don't understand," Sveta shrugged her shoulders. "How can stars make pictures? Did Doc draw them?"

"How do you get a picture in a jigsaw puzzle?" asked Father.

"You put the pieces together and so get a picture," said Sveta.

"Well, the pictures in the sky are made up of stars," said Father. "Is it clear now?"

"No, it isn't," said Alex firmly. "I can't see any pictures in the sky."

"Take a better look," said Father. "Can't you see an enormous dipper with a long handle?"

"Where's the dipper?!" the children shouted together.

"Right above your heads, four stars trace the dipper and three more the long handle. Can you see it?"

"I can see it," Sveta was glad to say.

"I can't see any dipper," said Alex.

"I'll try to explain it in a different way," said Father.

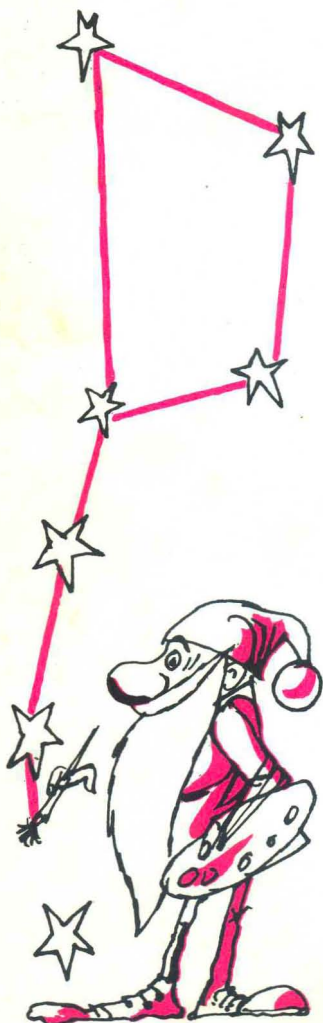
He drew a large dipper on the ground in the light of a torch.

"How many stars make up the Big Dipper?" asked Father.

"Seven," answered the boy.

"Right, remember this picture. There are no other bright stars in the sky where the dipper is, so look at the part of the sky Sveta and I showed you and find the seven stars making up the Big Dipper."

Sveta switched off the torch. When Alex's



eyes grew used to the darkness, he saw the Big Dipper.

"Maybe you only think you see it?" said Father.

"No!" Alex was upset. "I can see the dipper."

"Let's check," said Father. "Listen to my orders. Close your eyes and turn around. Now open your eyes. Can you see the dipper?"

"No, I can't," answered Alex, "the stars are different here."

"Very good," said Father. "Now find the Big Dipper yourself."

Alex turned his head in different directions and found the Big Dipper, he showed it to Father and Sveta.

When Alex and Sveta had remembered how the Big Dipper looked, Father said,

"There are many weakly twinkling stars in the part of the sky where the Big Dipper is found as well as the seven bright stars which form it. In olden times, people noticed the bright stars of the Big Dipper and the dim stars next to it and called them *Ursa Major* (which means Great Bear in Latin) constellation. They drew the bear on their maps of the sky."

Father showed the children two drawings.

"Look closely at these pictures and find the Big Dipper on each. Have you found it? Now tell me where the furthest star away of the Big Dipper's handle is on the Bear."

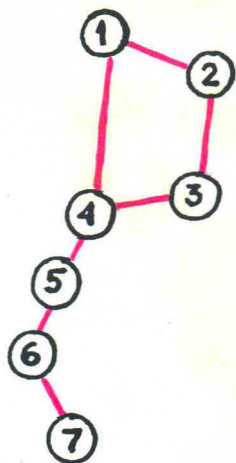
"At the end of the nose," said Alex.

"No, it's at the end of the tail," Sveta argued.

"Who's right?" asked Father.

"I'm right!" said Alex.

"No, I am!" replied Sveta.



The Great Bear

The following constellations may be observed from the territory of the Soviet Union at any time of the year:

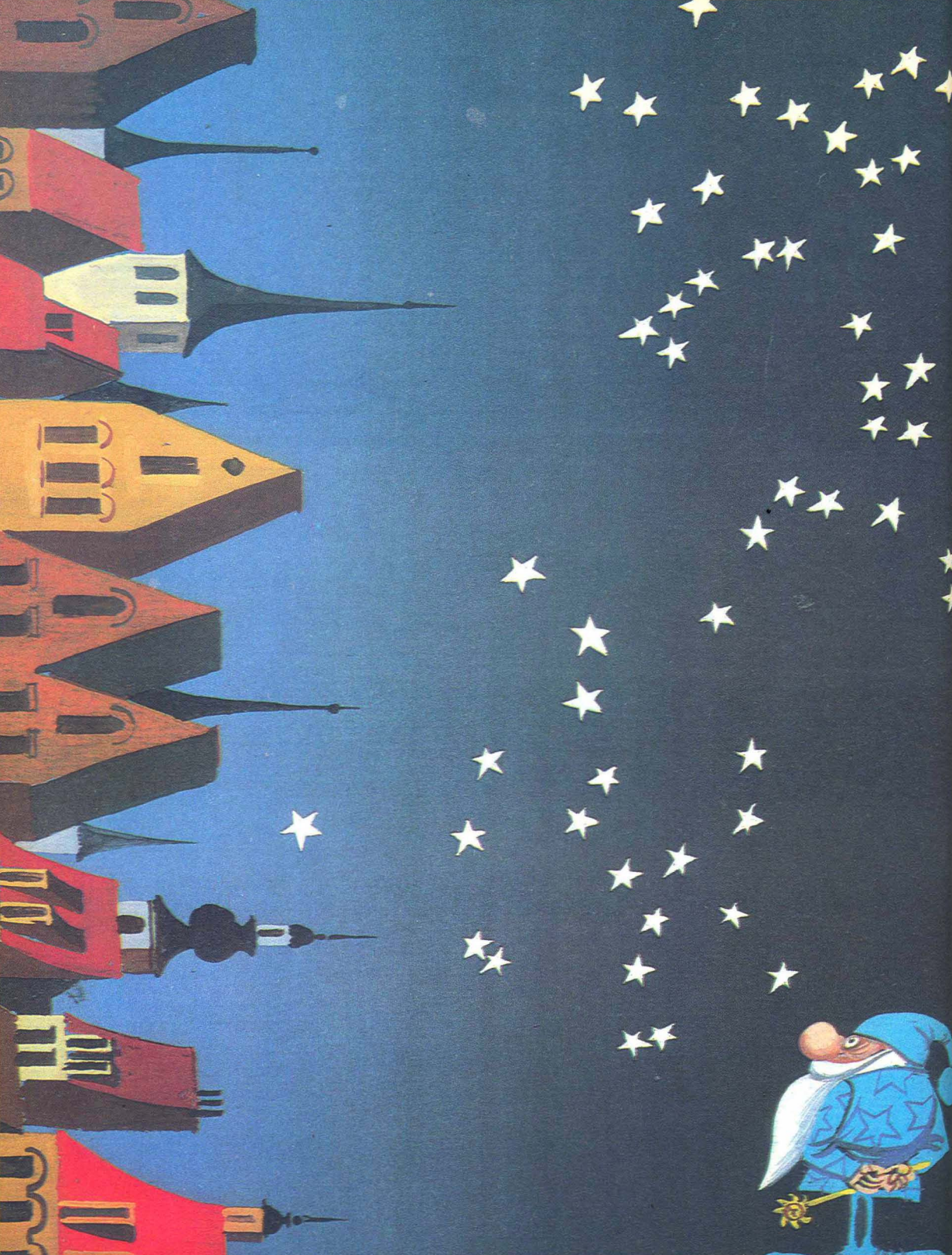
Ursa Major (Great Bear)

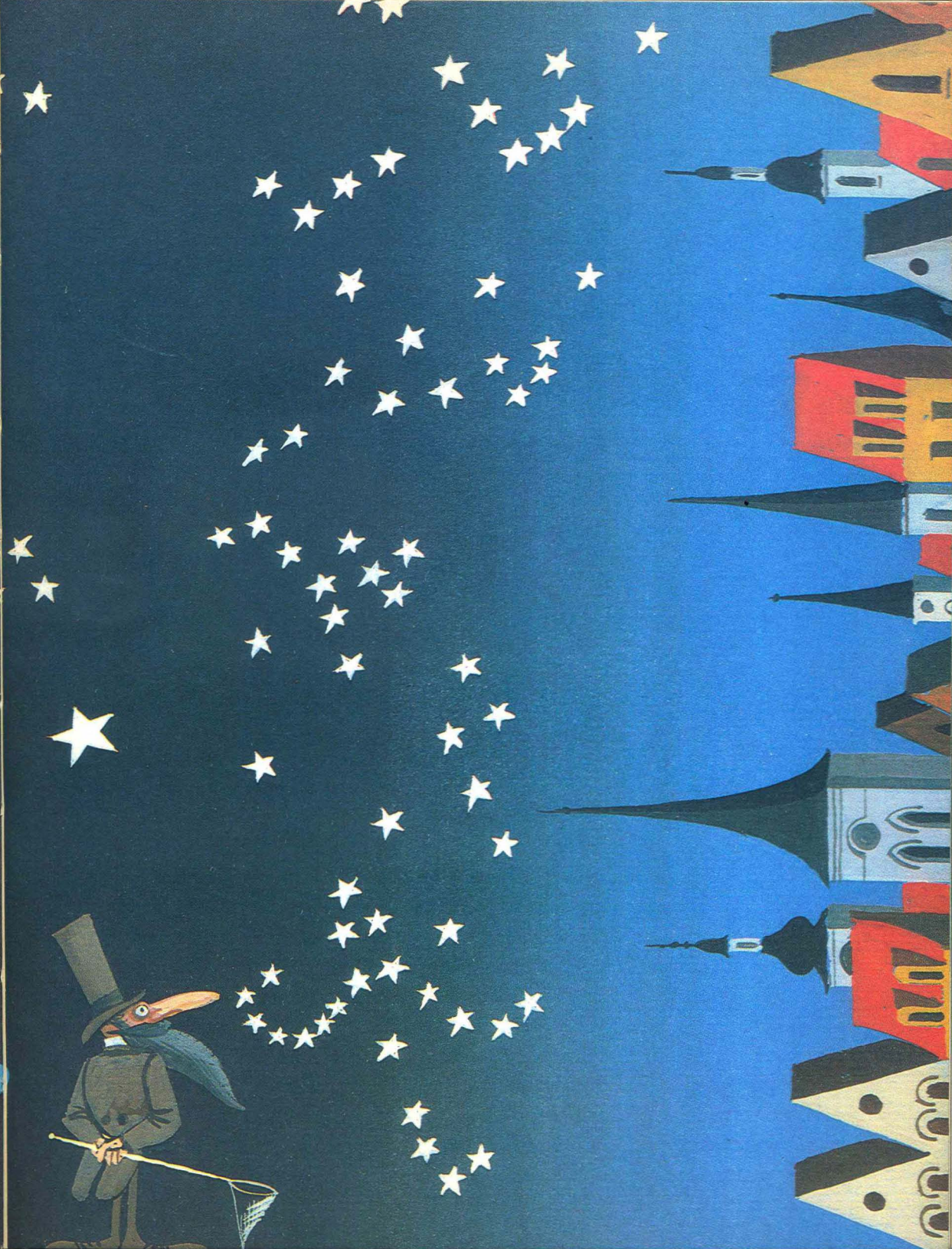
Ursa Minor (Little Bear)

Cassiopeia

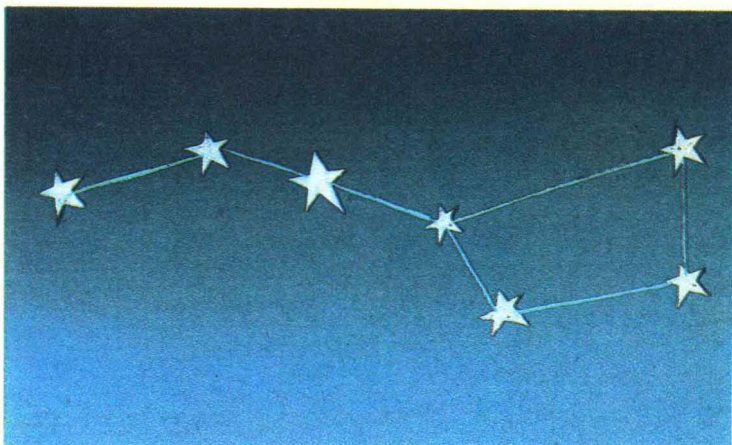
Cepheus

Draco

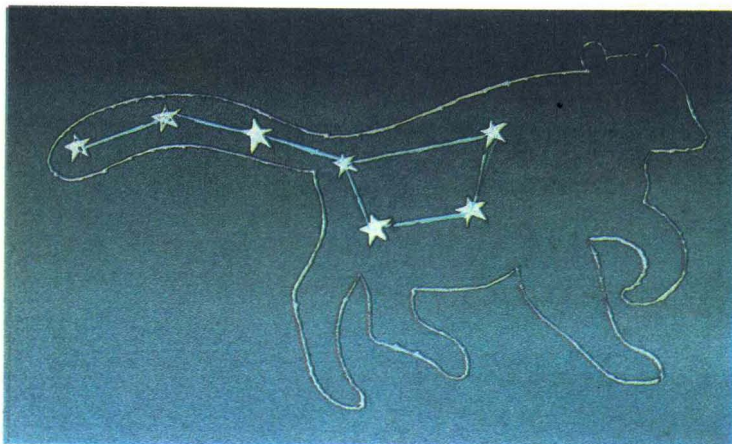




On winter nights, Ursa Major may be seen in the eastern part of the sky; in spring over one's head; and in summer in the western part (with the handle of the dipper pointing upwards)



In autumn, Ursa Major may be seen at about 9 p.m. in the northern part of the sky and in the morning, before sunrise, in the eastern part (with the handle pointing downwards)



“Now change drawings,” Father suggested to the children.

At this point the children saw that neither of them had been wrong, on one drawing the furthest star away of the dipper handle was on the bear's nose, on the other, on the tail.

“Which is the right drawing?” asked Sveta.

“They're both correct,” answered Father. “Everyone sees the dipper in the sky in the same way, but it's possible to imagine the bear in different ways.”

“Is there really a bear in the sky?” asked Alex.

"Of course not," answered Father. "But if you draw all the stars of the constellation and join them by means of lines, you'll get something looking like a bear. People noticed that a long time ago and called this group of stars the Great Bear."

"So the Big Dipper is the Great Bear, is it?" Sveta asked.

"Try to answer that question yourself," said Father.

"I've guessed it," cried Alex. "The dipper is not the whole bear."

"That's right, son," Father praised the boy. "Remember I said that the Big Dipper was made up of only the brightest stars, while the Great Bear constellation also includes many dim stars that can hardly be seen. **The Big Dipper helps us find the part of the sky where the Great Bear is found.**"

When there was another clear evening, Father asked the children to find the Great Bear constellation in the sky.

"There's the Big Dipper," said Alex, "that means the Great Bear is there too."

"Look carefully at the middle star in the dipper handle," said Father. "It's called Mizar. The name was given to it by the Arabs; in their language Mizar means horse."

"Why horse?" Alex wondered.

"It's called 'horse' because next to it there's a star you can hardly see. Try to make it out."

"I can see it!" cried out Sveta.

"Now I can see it too," said Alex.

"Well, well, that means you have excellent eyesight," Father was delighted. "The Arabs called the dim star Alkor. In their language that







means 'horseman' or 'rider'. It was believed that if a person sees Mizar and Alkor he could learn to be a marksman with the bow."

A Star-Compass

Today, Alex could not be comforted: he had lost his compass.

When Father learned about the loss, he said, "Now you'll have to find the north and the south by the heavenly bodies."

"What bodies?" asked Alex.

"The Sun and the stars, they are the heavenly bodies," answered Father.

"But the Sun and stars aren't a compass," said Alex with doubt.

"They're not a compass, but they're just as good," Father smiled. "Do you remember how you and Sveta looked at the shadow from the gnomon lit up by the Sun?"

"Of course I do," answered Alex right away.

"And do you remember when the shortest shadow was?"

"In the daytime."

"That's right, at about 12 noon. If you face the Sun at that time, the south will be straight in front of you and the north behind you. The shadow of the gnomon will stretch from south to north."

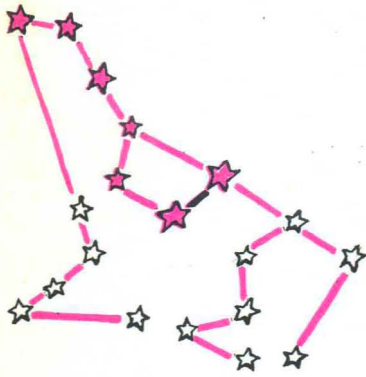
"But there are no shadows from the stars," said Sveta. "How can you find the north and the south at night?"

"There's a star in the sky which replaces the compass. It's called the North Star or Polaris."

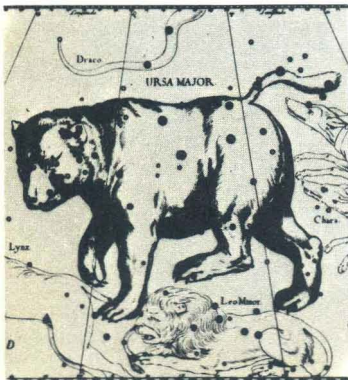
"How do you find it in the sky?" asked Alex.

"This will help you," answered Father and put a map of the sky in front of the children.

"Find two stars in the Big Dipper furthest



The constellation Ursa Major
(Great Bear)





from the handle.”

The children found these stars.

“Now draw a straight line from the lower star to the upper one,” said Father, “and continue it until it comes upon the first star. That will be the North Star.”

Father gave Alex and Sveta pencils and paper, and they drew the Big Dipper and North Star themselves.

In the evening the children saw the North Star in the sky. They found it in the same way as they had done on the map. First they spotted the Big Dipper, then the two stars furthest from the handle, and finally, the North Star.

“But where’s north?” asked Sveta.

“When you look at the North Star, the north is straight in front of you,” said Father, “and the south is behind you.”

“Now that’ll be my compass,” said Alex.

Tales About the Two Bears

One night the children were looking at a picture of the Great Bear constellation.

“Where’s the North Star?” Alex asked all of a sudden. “On the nose or on the tail?”

Sveta didn’t know the answer, so the children had to go and ask their Father where the North Star was in the Great Bear. And Father said,

“Nowhere.”

“Why nowhere?” the children did not believe him.

“I told you about only one constellation, the Great Bear, but there are many constellations in the sky. And the North Star is in another constellation, the Little Bear, or *Ursa Minor* in Latin.”

“Will you show us the Little Bear?” asked Alex.

"I will, but it's not so easy to find it in the sky, because there are not many bright stars in this constellation."

"Is there a dipper in the Little Bear, too?" asked Alex.

"Yes, there is, but it's a little dipper. The North Star is at the end of the Little Dipper's handle."

Father drew the Big Dipper on the paper, then the North Star, and finally the Little Dipper. He drew four of the stars in the Little Dipper very dimly, and three including the North Star brighter.

One night, when the sky was dark and clear and the stars were bright, Father showed the children the Little Bear constellation.

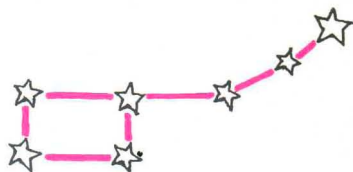
"In olden times, the Kazakhs called the North Star a pole," said Father, "and the other stars of the Little Dipper they said were sheep that were tied to the pole and which wandered round it. The Indians of South America said that the Little Bear was a monkey holding on to the North Star by its tail and walking round it."

"Pa, are these all stories about the Little Bear?" Alex wanted to know.

"Of course, and there are many more stories," answered Father. "For example, one story says that a mighty and evil goddess turned a beautiful girl named Callisto into the Great Bear."

"Is the Little Bear also someone bewitched?" asked Alex.

"Yes, it is," said Father. "The evil goddess turned Callisto's maid into the Little Bear. Since then the maid has always looked after her mistress. That is why the Little Bear is always next to the Great Bear in the sky."



The constellation Ursa Minor
(Little Bear)



How the Brave Perseus Rescued the Beautiful Andromeda

One day Alex asked his Father,

“You told us about two constellations: the Great Bear and the Little Bear. What about the other stars?”

“The other stars are in other constellations,” said Father. “There are the constellations of Leo (Lion), Draco (Dragon), Cygnus (Swan), Cetus (Whale), Aquila (Eagle).”

“Are there stories about these constellations, too?”

“Yes, almost all of them have special stories,” answered Father.

“Will you tell us them?”

“I’ll tell you some of them, and you can read the others when you grow up.”

Of course, Alex wanted to hear all the stories about the constellations, but what could he do? He called Sveta, and the children got ready to listen to another story.

Father began:

“Long, long ago, in the far-off country of Ethiopia, there reigned a king named Cepheus and a queen named Cassiopeia. They had one daughter whose name was Andromeda. Queen Cassiopeia was very proud of her daughter and liked to say that Andromeda was the most beautiful girl in the world. When the goddesses living in the sea heard about this, they were very angry. The goddesses always believed that they were the most beautiful women in the world. The sea goddesses wept and asked their father, the god of the seas, to punish Cassiopeia and Andromeda. The mighty ruler sent an enormous sea monster to destroy Ethiopia. The monster breathed out fire, and black smoke came out of its ears, its tail was covered by terrible rings with sharp spines.

The constellation Perseus



The monster threatened to burn all Ethiopia to the ground if the King and Queen would not give up their daughter. In order to save their country from being destroyed, Cepheus and Cassiopeia agreed to turn over their daughter to be eaten by the monster. The beautiful Andromeda was chained to a rock in the sea. But then the hero Perseus appeared and rescued Andromeda."

"How did he beat the monster?" Alex wanted to know.

"Perseus rose into the air on his magic winged sandals and pushed his sword into the monster's back. The monster rushed at Perseus but didn't catch him. Perseus hit the monster three more times and it drowned in the sea.

"Perseus freed Andromeda and brought her to the palace. The King was so glad he allowed Andromeda to marry Perseus. The party lasted for many days in Ethiopia. Since then the constellations of Cassiopeia, Andromeda and Perseus have appeared in the sky."

"Can you find them in the sky?" asked Sveta.

"Cassiopeia is the easiest to find in the sky. I'll explain how in a second, let's take a paper and pencil."

Their Father drew the Big Dipper, the North Star and the other stars of the Little Dipper. Not far from the North Star he drew five stars that looked like a W.

"That's Cassiopeia," said Father.

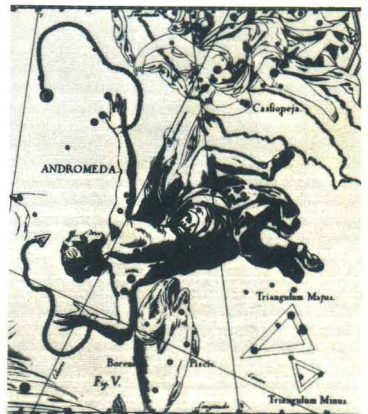
"It doesn't look like a queen at all," Sveta was disappointed.

"Of course it doesn't," Father agreed. "But the bears don't look like real bears either. People made it all up. And they not only drew the stars but drew the Queen on her throne as well. I'll



The constellation Cepheus

The constellation Andromeda





show you the constellation on an old map of the sky."

"Have you got a map like that?" Alex asked.

"Yes," answered Father. "Look what beautiful pictures there are here. In olden times, people drew bears, other animals, and the heroes of folktales, but today astronomers only draw stars. Here's a modern map of the sky. Can you find the Great Bear on it?"

"Here it is!" cried out Alex who spotted the Big Dipper very quickly.

"And now find the Little Bear."

"There's the Little Bear," said Sveta.

"Now then, where's the Cassiopeia?"

And the children found her as well.

One evening during a walk, very few stars could be seen in the sky.

"What a dull sky it is tonight," said Alex.

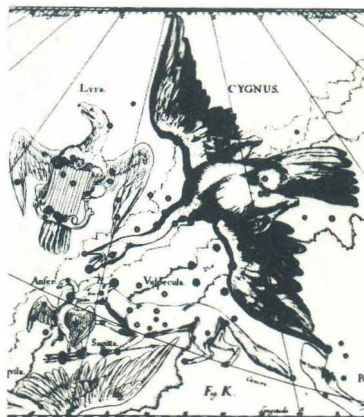
"Perhaps you're right," Father agreed, "but then you can see the stars which Doc asked me to show you very well. Do you see the three bright stars to the left and slightly below the Great Bear. If you join them together, you'll get a big triangle. That's what they're called, the summer-autumn triangle, because you can only see them in summer and autumn at night."

"Then it's the triangle constellation!" said Alex.

"No, it isn't," said Father. "The stars I'm showing you now do not belong to one, but to three different constellations. Each constellation has its own name: one is the Swan, the other Lyra and the third the Eagle, and each star in the constellation has its own name too. The brightest star in the Swan constellation is Deneb, Vega is the

A Triangle in the Sky

The constellation Cygnus (Swan)





The constellation Lyra

brightest star in the constellation Lyra, and slightly lower than Vega is Altair, the brightest star in the Eagle. It's not easy to remember the names of these stars, but it isn't difficult to find them in the sky because if you join them together, they look like a big triangle."

At home, Father showed Alex and Sveta pictures of the new constellations on the map of the sky.

"Dad, do these constellations have stories too?" asked Sveta.

"I don't think there is a story about all three," answered Father.

"What's a lyra?" asked Alex.

"A lyra, or lyre is a musical instrument," answered Father. "In one of the stories, the wonderful musician Orpheus played on the lyre and sang. He sang so well that even wild animals listened to his singing."

"Do you know a story about the Swan too?" asked Alex.

"Different stories are told about the Swan. In some, a magician turned Orpheus into a Swan. In others, the Swan is not Orpheus at all but a brave warrior called Cygnus (the name Cygnus comes from the Greek word meaning swan) and for that reason the constellation is usually known as Cygnus. But I don't know a story about the Eagle or Aquila, the Latin word. The people in olden times said that the Eagle was just an eagle, but it was very ferocious, and it kept flying to the rock where Prometheus was tied up and pecked at him."

"Why did the eagle peck at him?" asked Sveta.

"Prometheus had stolen fire from the gods and brought it down to the people. The gods were

The constellation Aquila (Eagle)





very angry of course and they seized Prometheus, chained him to a rock, and ordered the eagle to peck Prometheus over many years.

The Hunter Fighting a Bull

Autumn passed and winter set in. It was too cold to go for a long walk in the evening. Nevertheless, occasionally Father went outside with the children. The children quickly found the Great Bear and even Cassiopeia in the sky. But the other constellations which had been seen so clearly before — the Swan, Lyra and the Eagle — had now disappeared and the children could not find them even though they tried hard.

Sveta was very upset.

"Pa, we must've forgotten everything!"

"No you haven't," he said, "it's just that now many constellations cannot be seen. We saw them in summer and autumn, and now it's winter. The Great Bear, Little Bear and Cassiopeia can be seen in the northern half of the world in winter and summer but the other constellations can only be seen in winter or in summer. That's why you can't find a summer constellation on a winter night."

"Dad, please tell us about the winter constellations," Alex asked.

"One of the most brilliant winter constellations is Orion. It is situated in the southern part of the sky and looks like a large bow knot."

When the children had found the constellation, Father asked,

"Do you see the chain of bright stars in Orion? How many are there?"

"Three," answered Alex and pointed to the stars which were next to each other along a straight line.

The large nebula in the
constellation Orion



"Now find a tiny spot of light made up of many stars not far from Orion."

Sveta carried out Father's instructions before Alex did, and having praised her, Father said,

"Look closely at those dim stars. What do you see?"

"Nothing," answered the children.

"Find the Great Bear and the Little Bear again," said Father. "Now look at the dim stars once more."

"Dad!" cried out Alex. "There's a tiny little dipper, too."

"I can see the dipper, too. How teeny-weeny it is," Sveta said.

"I'll tell you about two new constellations at home," said Father.

On the way home, Alex asked,

"Dad, you told us about one, Orion, which is the other?"

"That's right," Father agreed. "The constellation like a bow knot with three stars in a straight line is Orion. But the tiny dipper of stars belongs to the next constellation, Taurus."

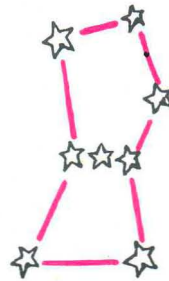
"What?" asked Alex.

"Taurus or the Bull," said Father.

At home, Father showed the children an old map of the sky. He said,

"Look, here's Orion, he's a hunter fighting a bull. The three bright stars which you noticed in the sky are on the hunter's belt. Next to him is the constellation Taurus."

It was a clear evening on Saturday, and Father asked the children to find Orion in the sky during their walk. Orion's belt was very clearly seen, and the children quickly spotted the constellation. Then they found the tiny dipper in the



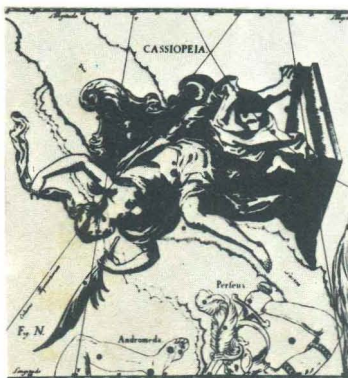
The constellation Orion



Can People Live on the Stars?



The constellation Cassiopeia



Taurus constellation. Their Father said that astronomers called the stars which made up the dipper the Pleiades. Not far from the Pleiades was a brilliant red star with a difficult name Aldebaran — the bloodshot eye of the fierce bull.

The children were looking with interest at the drawings of constellations which Alex and Sveta had taken to the kindergarten.

All of a sudden, Lena asked,
“Does someone live on the stars?”

Sveta and Alex had not had time to open their mouths when Serge yelled,

“Of course they do. Bears live on the bears, bulls on Taurus, and different other animals and all sorts of Queens do.”

Alex was annoyed.

“It’s not true, Serge,” he cried. “There are no bears in the sky!”

However, Serge was not giving in.

“Why not? There are animals in the forest and in the Zoo, why shouldn’t there be any in the sky?”

Sveta and Alex didn’t know how to explain why no one lived on the stars, and couldn’t make Serge believe them, so they told their Father about it in the evening. Father said,

“You see, you were right but they didn’t believe you because you couldn’t prove what you said was correct.”

“How could we prove it?” Alex asked rather unhappily.

“For example, you could say that there are no animals and kings in the sky at all because people invented the drawings of the constellations. It was a long time ago when no one knew any-

thing about the sky and the stars, and they seemed a mysterious world of fairytales. You do know that no one can live on the stars, neither animals nor people, don't you?"

"No, we don't," Alex shouted out.

"You never told us that," Sveta supported her brother.

"Didn't I tell you about the land of a thousand suns?" Father asked in surprise.

"Yes, you did," Alex remembered right away.

"And what are those thousand suns?" Father asked the children.

"The thousand suns are the stars," Sveta answered.

"But if you remember that the stars are suns, have you forgotten that no one can live on the suns, because it's very, very hot on them?"

"Are the stars as hot as our Sun?" Alex was not sure.

"Of course they are, they're even hotter," answered Father.

On a clear cold night, Father and the children set out for a walk. The sky was very dark, and the stars shone brilliantly in it.

"Dad, what's that star there," asked Sveta.

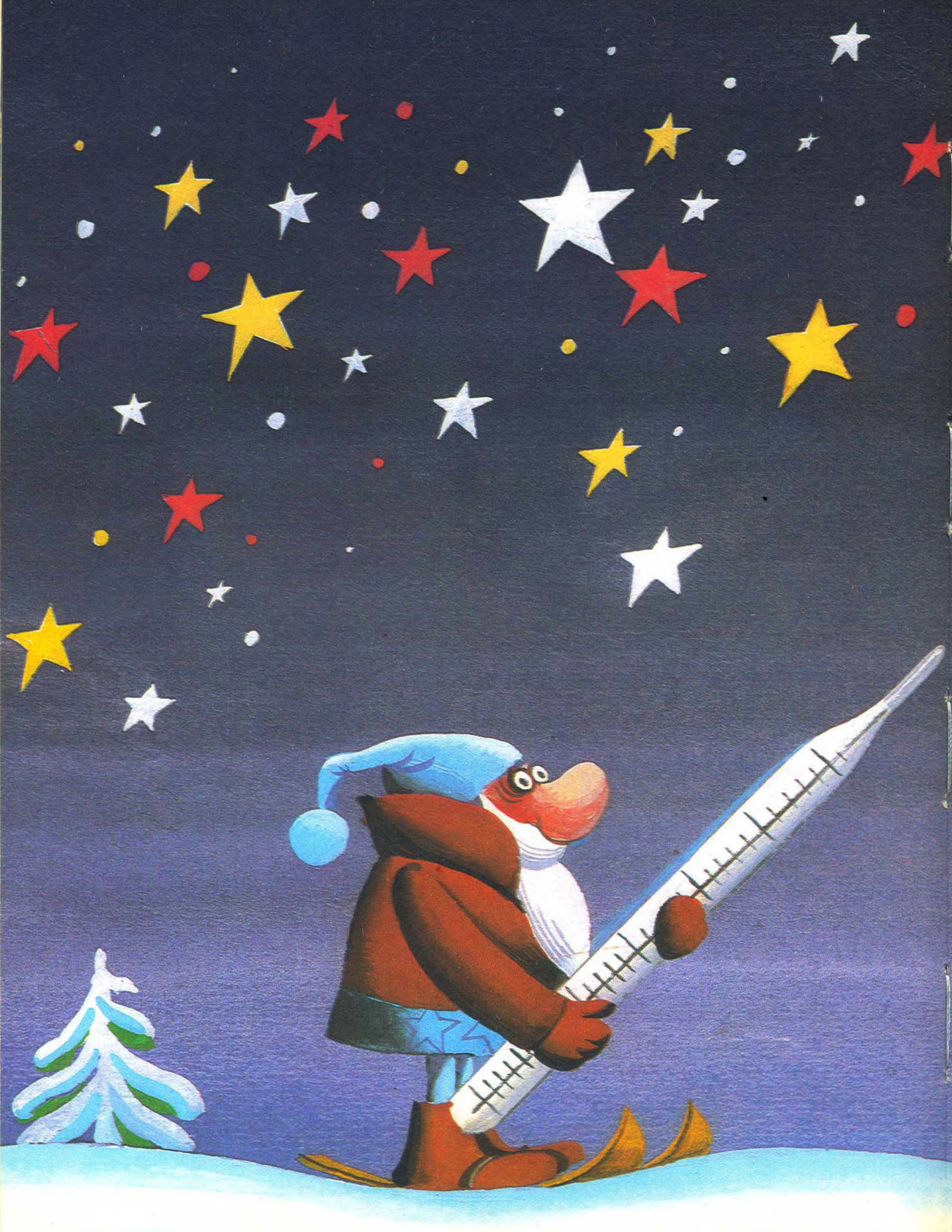
"Where?" Alex began turning his head in all directions.

"Can you see Orion's belt?" Sveta asked. "What's the star to the left and a bit lower."

"That's Sirius, the brightest star in the sky," said Father. Another interesting star can be seen above the constellation Orion, called Capella. It's yellow in colour."

"Pa, why do stars have different colour?" Sveta asked.

In the World of the Distant Suns





This was how the stars were
observed in the past

The temperature of the surface of
white stars reaches $100,000^{\circ}\text{C}$;
yellow stars $6,000^{\circ}\text{C}$; red stars
 $3,000^{\circ}\text{C}$ and less



“It’s because they’ve got different temperatures. White stars such as Sirius are very, very hot. They’re hotter than the Sun. Yellow stars, Capella, for example, are not as hot as the white ones. They’re about the same as our Sun. The star Aldebaran in the constellation Taurus which you already know is red and it’s colder than the Sun.”

“Dad, you said the stars are hot, why don’t they warm us at all, we’re freezing?”

“If you’re freezing, it’s time to go home,” said Father. “We’ll talk some more when you warm up.”

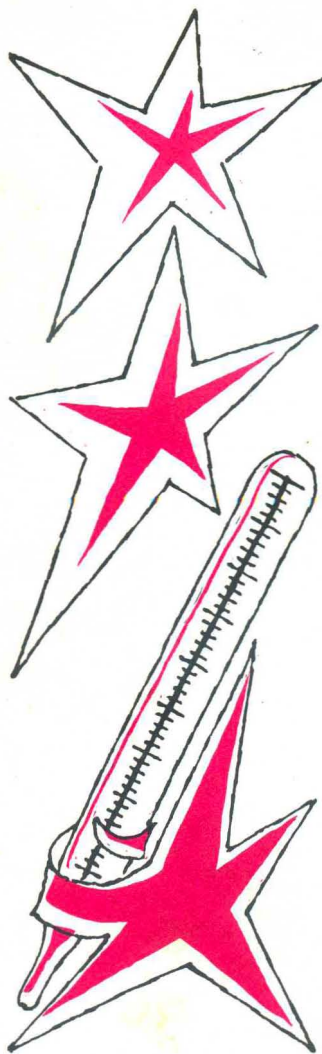
“I wonder, do you remember the name of Doc’s best friend?” said Father at home.

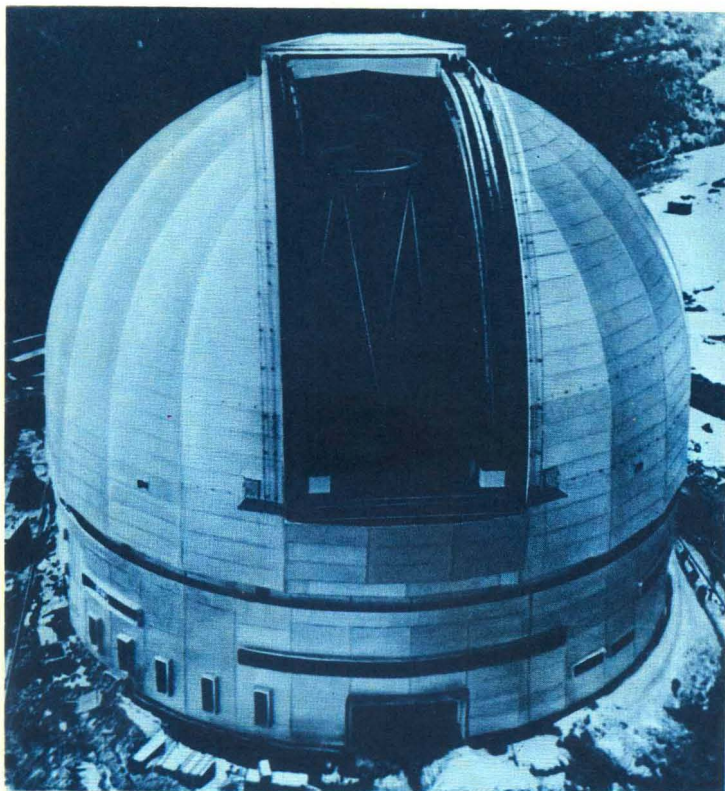
“We do, we do, he’s Ray,” the children cried.

“Right, a ray of the Sun,” said Father.

“Do the stars have rays?” asked Sveta.

“Of course they do,” answered Father. “Rays come rushing towards us from every star. And





The largest telescope in the world has a 6-metre mirror and is installed in a special astrophysics observatory belonging to the Academy of Sciences of the USSR. The telescope is for observing the most distant stars and star systems

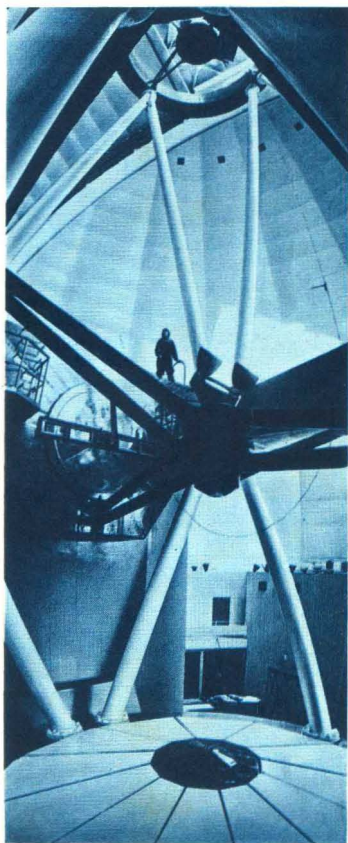
they tell scientists many interesting things. It is from the rays that we learn which stars are hotter. They also tell us how long it takes them to travel from the stars."

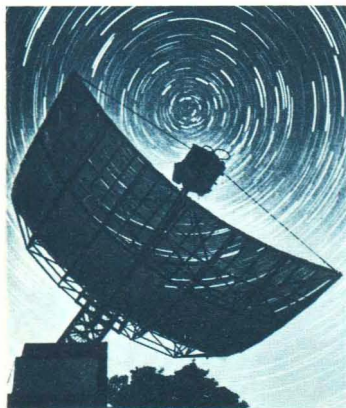
"Does it take long?" Alex asked in wonder.

"It takes very long," said Father. "It takes a ray more than eight years to get here from Sirius, for instance. You were not even born when the ray which arrived here today set out from Sirius. But Sirius is near and other stars are much further away from us..."

"Is Aldebaran further away than Sirius?" asked Sveta.

"Yes, it is, Ray flies almost seventy years from Aldebaran," Father answered, "and several hundred years from the North Star."





A small radiotelescope against the sky: the picture was photographed by a fixed camera

The children listened with bated breath!

"Now that you know that the stars are very far from us, can you tell me, are the stars big or little?" Father asked the children.

"I think the stars are big," answered Sveta. "They're very far away, but we still see them. That means they're very big."

"When I grow up and become an astronaut, I'll fly to the stars," Alex dreamed.

"You can't fly to the stars," Sveta was angry. "It's very hot there."

"Then I'll fly near them and turn my rocket back," Alex said.

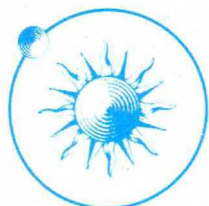
"There is no spacecraft yet which can travel to the stars," said Father.

"But I'll fly with Doc," Alex answered.

"Well, then perhaps you'll be able to go to the most distant stars..."

"I'll fly from one star to another," Alex continued to imagine.

"That would be a wonderful magic trip to the world of the distant suns," said Father. "You would see big hot spheres many of which are bigger than our Sun. Some of the suns are yellow like ours. Others are white like Sirius. Still others are red like Aldebaran. All of them are very hot, so you'll have to look at them from a long way away."



THE SOLAR SYSTEM

The purpose of this section is to give children an idea of the Solar System, the planets and their satellites. The planets do not emit their own light but are seen in the sky only because they are lit up by the Sun. At first glance, the planets look like bright stars, but upon closer examination, it can be noticed that the planets do not twinkle like the stars, and through field glasses you can see that they are not points but small discs. If you observe the planets for a long time (several weeks or even months), you may notice that they change their positions relative to the stars, passing from one constellation to another. Many superstitions are linked with the planets, and for that reason it is important to provide children with a correct idea of these heavenly bodies.

The section deals, for the first time here, with the actual movements occurring in the Solar System. Until now we have only considered the movements of the Sun and other astronomical objects that are observed from the Earth. This is a very complicated question, so pay particular attention to it. The most important points that children should understand are: that the Moon revolves round the Earth, that the Moon is the Earth's satellite, that the Earth revolves round the Sun, and that the Earth is the Sun's satellite and is one of the planets of the Solar System. To explain this, you will need a simple model: a small coin to depict the Earth, a circle with a diameter 4 times smaller than the coin to represent the Moon, and a big circle 164 cm in diameter (cut out of thick paper and coloured yellow) to provide an idea of the Sun's size. In addition, make the children themselves act the part of the heavenly bodies and imitate

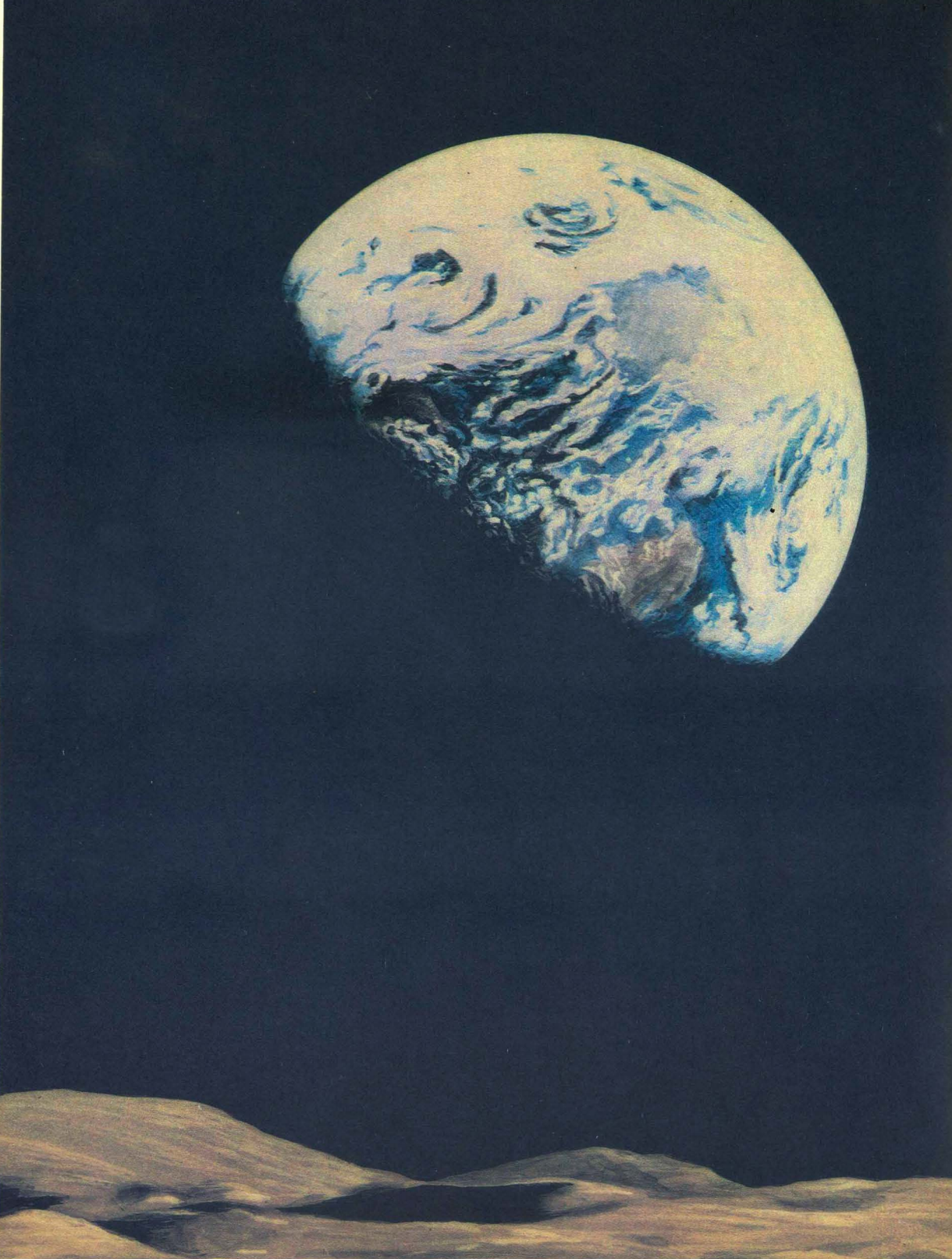
their movements and then pass over to the simplest schemes.

In order to observe the planets with the children, you should refer to an astronomical calendar. This will help determine when and in what part of the sky the planets can be clearly seen.

It is best to begin observations of the Moon when there is a full moon.

The children must notice for themselves that the Moon changes its appearance. Only after they have done this, read the explanation of the phenomena to the children and do the experiments described in the book.





One day, Father took field glasses along on their evening walk and showed the children the Pleiades through them. Then, instead of the dim tiny dipper, Sveta and Alex saw many other stars through the field glasses.

"That means that with field glasses we can see many more stars in the sky," said Father.

The children took turns looking through the field glasses, pointing them first at one part of the sky and then at another. Every time they could see that there were many more stars in the sky than could be seen by the naked eye.

"Which one of you can remember the constellation where the Pleiades are?" asked Father.

"It's in Taurus," said Sveta and added, "that constellation has a red star."

"And it's called Aldebaran," Father helped the children. "By the way, where is it?"

At this point, the children saw "two Aldebarans" not far from the Pleiades, two red stars.

"Dad!" Sveta cried out. "Another Aldebaran has appeared."

"No, children, it's not another Aldebaran," said Father. "It's not a star at all."

"What is it then?" Sveta asked in surprise.

"Try to point the field glasses first at one red star, then at the other."

It was a difficult task, the stars didn't want to be caught in the field glasses, and the children were forced to spend a lot of time looking at them.

Through the field glasses, the children saw that the two stars looked different, one was a red point, the other was a small circle.

"The real Aldebaran is seen to be a point," said Father. "But the star which looks like a cir-

Another Aldebaran?

The Earth from the surface of the Moon









cle is not a star but is the planet Mars."

"Where was Mars before?" asked Sveta. "We never saw it before."

"You're right," Father agreed. "Mars is travelling through the sky and has paid a visit to Taurus. He'll stay there for several weeks and then leave again."

"So Mars is a traveller?" asked Alex.

"Yes, he is. But he's not the only one to travel through the sky," said Father. "In olden times, people had noticed several heavenly bodies wandering among the stars. These heavenly bodies were called planets. Mars is one of the planets."

"Dad, is the Moon a star or a planet?" asked Alex.

"It's neither a star nor a planet," Father answered.

"Then what is the Moon?" Sveta was a little mixed up.

"We'll talk about the Moon some other time," said Father. "When there is a moonlit night."

What Is the Moon?

"There are only a few stars in the sky tonight," said Alex.

"But the Moon is beautiful and very round," Sveta said.

"It was not by chance that I chose moonless nights for our walks," said Father. "But tonight we need the Moon and not the stars. I wonder, what do you know about the Moon?"

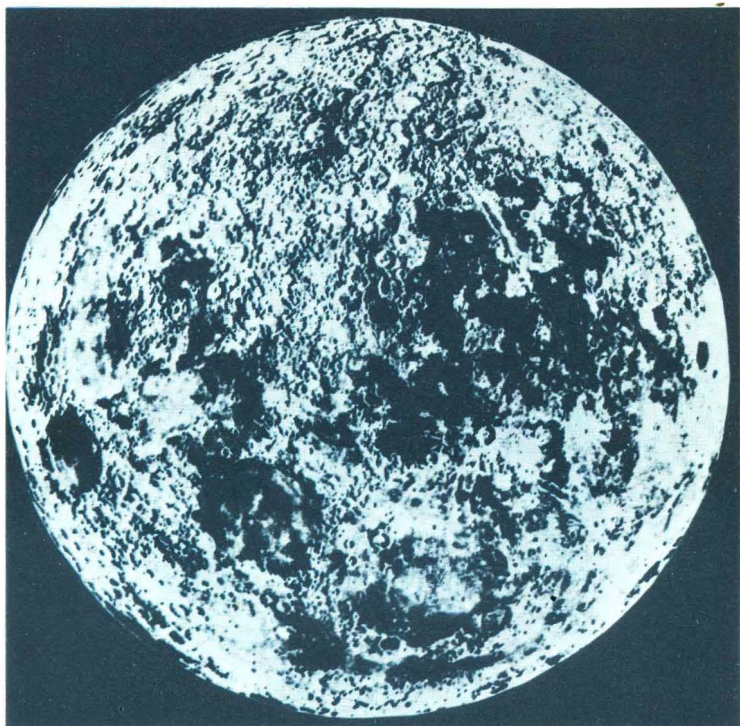
"You can fly to the Moon on a rocket," said Alex.

"People have already been on the Moon," Sveta added.

"Tell me, which is further away, the Moon or the stars?" asked Father.



The Moon is the nearest heavenly body to the Earth and the Earth's satellite. The average distance from the Earth to the Moon is about 384,000 kilometres



“The stars are further,” said Sveta quite certainly.

“Yes, the stars,” said Alex. “No one can fly to the stars, but they can fly to the Moon.”

“You’re right, the Moon is nearer than the stars and the Sun,” Father agreed. “It’s the closest heavenly body to us.”

“How long does it take Ray to fly from the Moon?” asked Sveta.

“Just over one second,” answered Father. “Ray has time to reach us while you slowly say the word o-n-e. But it takes several days to reach the Moon on a space rocket, because although the rocket flies fast, it can’t keep up with a ray of light.”

“Dad, which is bigger, the Moon or the stars?” asked Alex.

"You should be able to answer that question yourselves," said Father. "You know that the stars are very far away, much farther than the Moon, and that's why they seem tiny to us. Actually, they're much bigger than the Moon."

"Then the Sun is also bigger than the Moon, isn't it?" asked Alex.

"Yes, it is, the Moon is the closest heavenly body to us and that's why it seems so big. Actually, the Moon is much smaller than the Sun and the stars."

"Why does the Moon shine?" asked Alex. "You said it wasn't a star, didn't you?"

"The Moon doesn't give out any light itself," answered Father. "It is lit up by the Sun and that's why it's seen in the sky. Look at the Moon through the field glasses."

"What a beautiful ball," Sveta said.

"You can see very well through the field glasses that **the Moon is a sphere**," Father remarked.

"How many different things are on the Moon!" cried out Alex. "And where are its eyes and mouth? I can't see them through the field glasses."

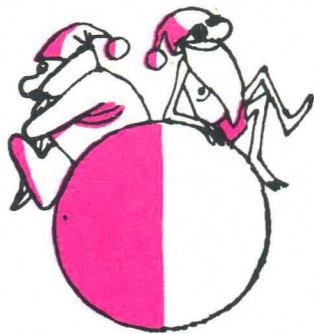
"There's nothing of that kind on the Moon," Father laughed. "The dark spots seem like eyes, a nose and a mouth to us from far away. Actually, they are firm and quite flat parts of the Moon's surface. They are called seas."

"I'd like to go swimming in the Moon's seas," Alex started wishing.

"You certainly wouldn't drown in the Moon's seas," said Father.

"Why?" asked Alex.

"Because there isn't a drop of water in them!"



During the daytime, which lasts two weeks, the surface of the Moon is heated to 150°C , and cooled to minus 120°C during an equally long night





"Why are they seas then?"

"The dark spots on the Moon were called seas before it was known that there's no water or air on the Moon, no rain or snow, no cloudy days..."

"How can you live on the Moon if there's no water or air?" asked Sveta.

"You can't," answered Father. "The astronauts who flew to the Moon could only walk there wearing spacesuits."

"Dad, Dad, I see a round hole on the Moon with rays coming from it. What is it?" cried out Alex.

"It's one of the many craters on the Moon."

"What's a crater?" asked Sveta.

"Craters are pits or holes made by large rocks which fell onto the Moon."

"Dad, what did the astronauts do on the Moon?" asked Sveta.

"They studied it using different machines and collected many moon stones."

"Dad, can you see the stars from the Moon?" asked Alex.

"Yes you can, and you can even see the brightest ones in the daytime when the sun shines. Besides the stars and the Sun, you can see our Earth in the Moon's sky."

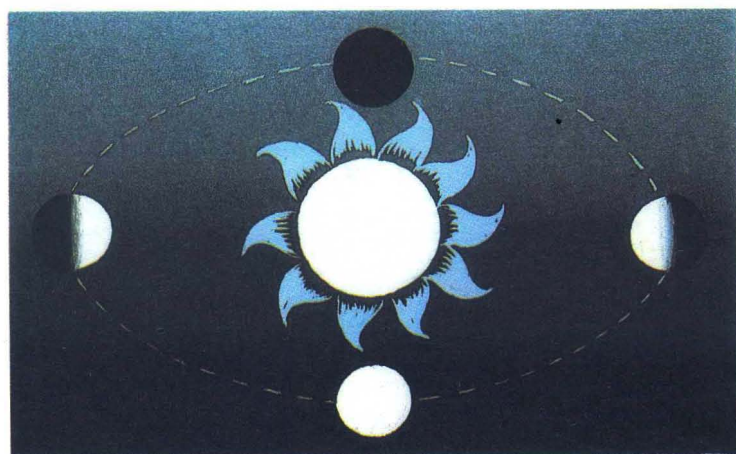
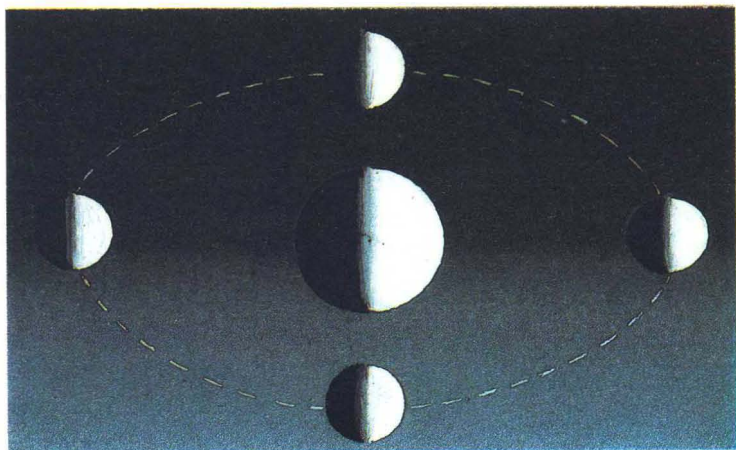
"The Earth?" Alex was surprised.

"Yes the Earth, you can watch the Earth from the Moon as we are now watching the Moon from the Earth," said Father.

One evening the children, together with Father, were looking at a book with many photographs of the Earth taken from outer space. Some of the pictures showed the whole Earth, others only



The Earth
Is Our
Spacecraft



part of it. Their Father explained that the Earth had been photographed from the Moon, from artificial earth satellites and from spacecraft. Most of all the children liked the picture where the Earth was seen in the Moon's sky as a blue sphere.

"Dad, what does the Earth hang on?" asked Alex.

"Nothing," answered Father. "Just like the Moon."

"Can't the Moon fall on Earth?" Sveta was troubled.

"Don't worry, the Moon won't fall on Earth. It won't fall because it doesn't hang over the Earth but moves quickly round it," answered Father. "The Moon is the Earth's satellite."

"Is it an artificial satellite?" asked Alex.

"No, it isn't" Father laughed. "Artificial satellites are those that are made and are put into orbit by people. But the Moon is a real heavenly body."

"And what's the Earth?" asked Alex.

"It's also a heavenly body," Father said. "It's one of the planets."

"And the Sun?" asked Sveta.

"The Sun and the stars are also heavenly bodies, of course!" said Father.

"And Mars?" asked Alex.

"Like the Earth, Mars is also a heavenly body. There are many heavenly bodies," said Father. "They include the stars, planets and satellites of planets. You know that the stars are hot spheres. They give out light because they're very hot. The other heavenly bodies, planets and their satellites, are cold. They give out no light themselves, but the Sun lights them up, and that's why we see them."

"Then the Sun is like a lamp," said Alex.

"You can put it that way," Father smiled.

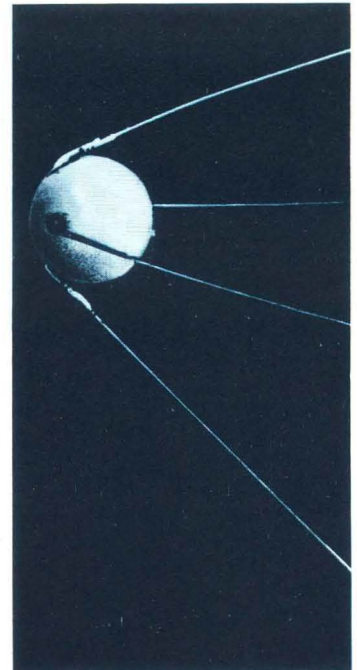
"You can also say that the Sun is a lamp which moves round the Earth..." Alex added.

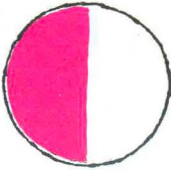
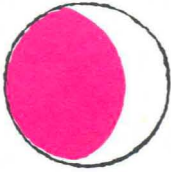
"No, you can't say that at all," Father said. "The Sun doesn't move round the Earth."

"But we saw ourselves that the Sun travels through the sky," Alex said.

"We did, but don't always trust your eyes,"

The first artificial Earth satellite





A waxing Moon. What letter does the crescent resemble?

said Father. "It seems to us that the Sun moves round the Earth in the sky, but actually it's the other way round. The Earth goes round the Sun..."

"And we're moving?" Alex said.

"We're not just moving, we're flying through outer space at a great speed together with our Earth," said Father.

"Like the astronauts?" asked Alex.

"Even faster!" answered Father. "We've got the best spacecraft, our Earth, which flies round the Sun faster than any space rocket..."

"What if we hit the Sun?" asked Alex.

"We won't," Father soothed him. "We're not flying to the Sun but round it and our flight takes place a long way away from the hot body. Let's draw a picture of how the Earth moves round the Sun."

Together with their Father, the children first drew a large circle which Alex coloured yellow. This was the Sun. Next to it, Father drew a small circle which Sveta coloured blue. This was the Earth. Then Father drew a red line round the Sun. This was the path which the Earth moved along.

Why Is the Moon Always Different?

Father gave the children some work to do, to look at the Moon and draw it every time in their notebooks. Now, Sveta and Alex would draw the Moon after every evening walk. On some drawings the Moon was a circle, on others only a half circle, and later there were drawings where there was a little crescent instead of the circle.

"Why's the Moon so different?" asked Alex

looking at his and Sveta's drawings in surprise.

"Try to understand why," answered Father. "Bring a ball and a torch. Imagine that the ball is the Moon and the chair on which Alex is seated is the Earth. Sveta will take the ball and move round the chair as the Moon moves round the Earth, while I'll back away from you with the torch. The torch will represent the Sun.

Father switched off the lights.

"Can you see the Moon clearly?" Father asked Alex.

"I can't see it at all," answered Alex.

"That's how it should be, the Moon does not give any light by itself," said Father. "Now I'll turn on the torch. Sveta, stand between the Sun and the Earth, and you, Alex, tell me whether the ball is lit up well."

"It's badly lit up," said Alex.

"The same thing happens with the Moon when it's between the Sun and the Earth, we can't see it from the Earth. Now Sveta please start to move round the chair on which Alex is seated, make two small steps."

"I can see a crescent," cried out Alex who was watching the ball closely.

"Sveta, move further on. What do you see now, Alex?"

"I can see half a ball."

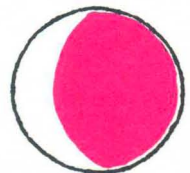
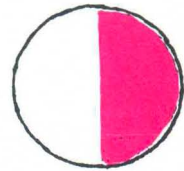
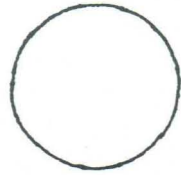
"Good. Sveta, continue moving. That's enough. You've gone exactly half way round the Earth."

"The whole ball is lit up," cried out Alex.

"Now then, when is there a full Moon in the sky?" asked Father.

"There's a full moon when the Earth is bet-

A waning Moon. What letter does it resemble now?



ween the Sun and the Moon,” answered Sveta.

“That’s all,” said Father and switched on the lights. “Now we know why the Moon looks different in the sky. From the Earth we can only see the part of the Moon which is lit up.”

Day Follows Night

Their Father put a globe and a lamp on the table, and said,

“The globe is a tiny model of our Earth. On it you can see the oceans and the land which are on the real Earth. You can see that the globe turns on its axis. The Earth turns in the same way.”

“Does the Earth spin like a top?” asked Alex.

“Yes, it does, our enormous Earth spins like a top, only much slower. A whole day passes while it makes one turn, and there are 24 hours in a day.”

“And 60 minutes in every hour,” added Sveta.

Then Father took a pin and stuck it into the globe.

“What did you do that for?” asked Sveta.

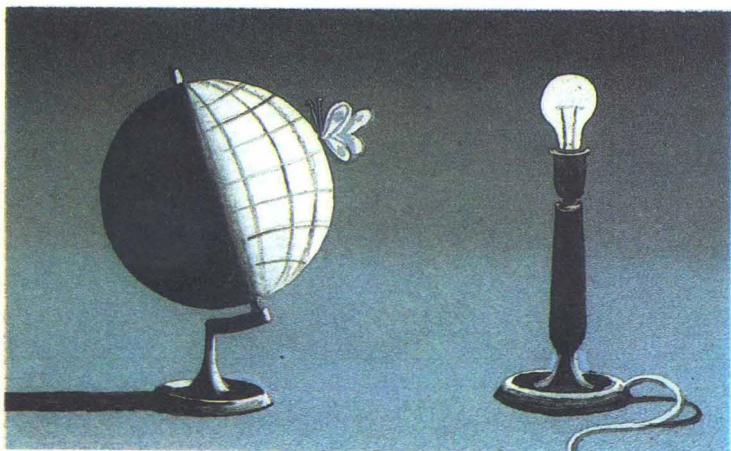
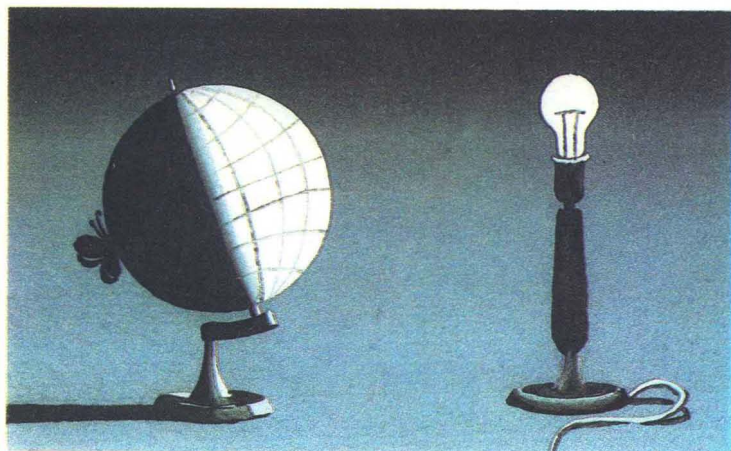
“I did that to show you where we live,” said Father. “Alex, please turn on the lamp, and you Sveta, please turn off the top lights. Look, the lamp is the Sun, the globe is the Earth. The pin on the globe shows the place where we live on Earth, is it lighted up now?”

“Yes, it is,” said the children.

“That means it’s daytime in our city now,” said Father. “I’m turning the globe and you can see that our city is on the part of the globe which is not lit up by the Sun. What do you think the people of our city will say now?”

“They’ll say it’s night,” said Alex.





“When will it be daytime again?” asked Father.

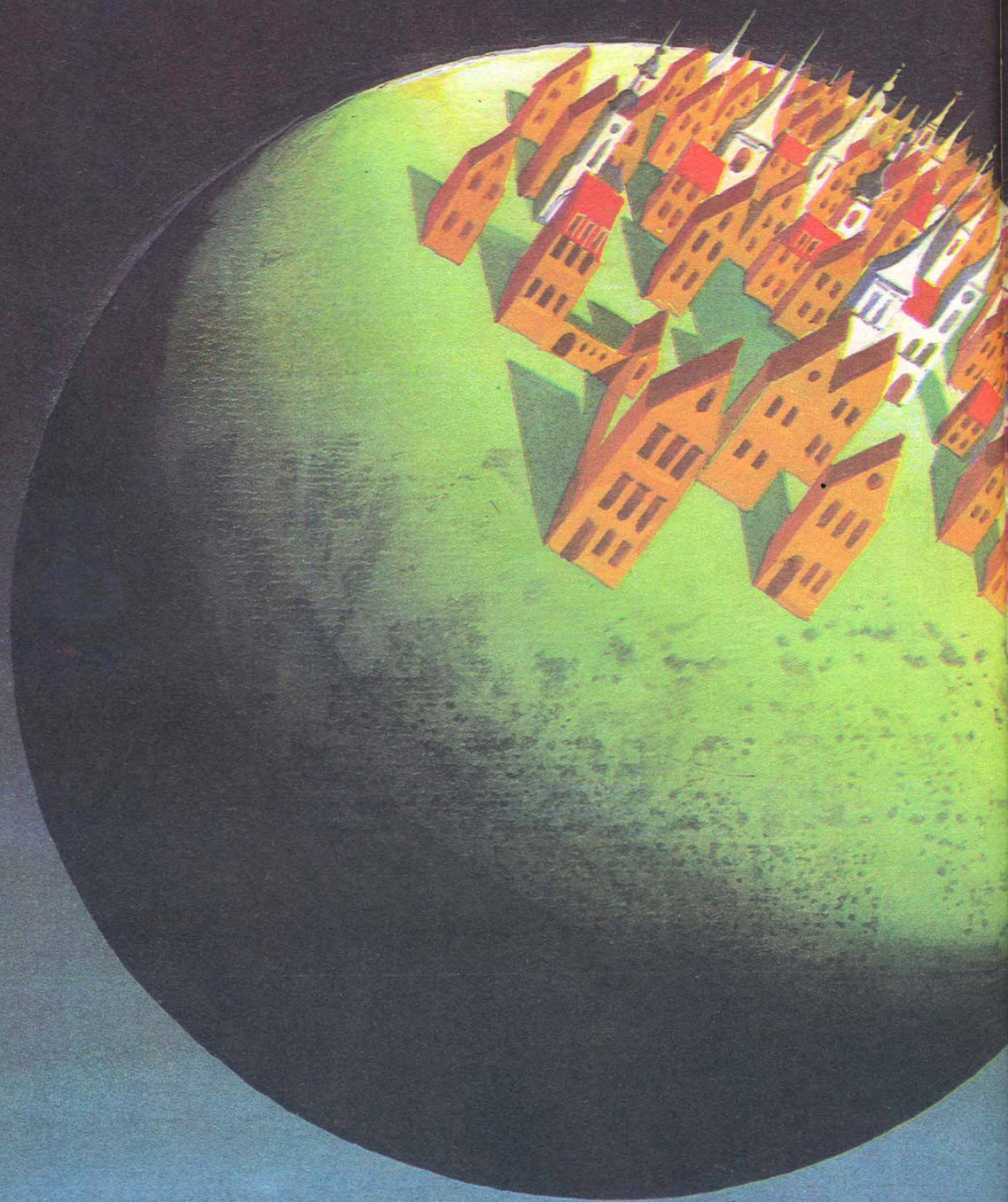
“When the Earth will turn some more and the Sun will light us up again,” answered Sveta.

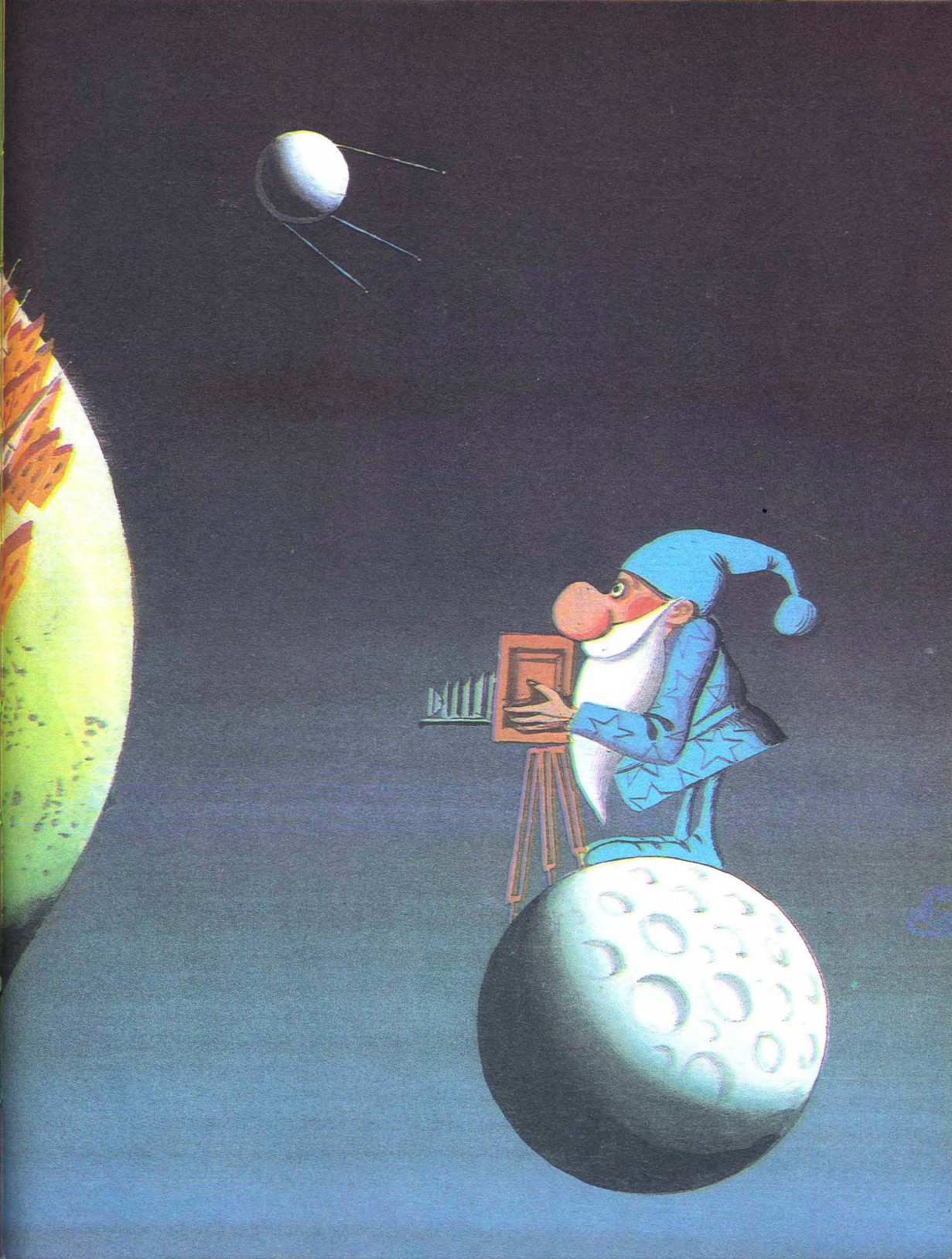
“Now then, why is there day and night on Earth?” asked Father.

“Because the Sun first lights us up and then goes dark,” said Alex.

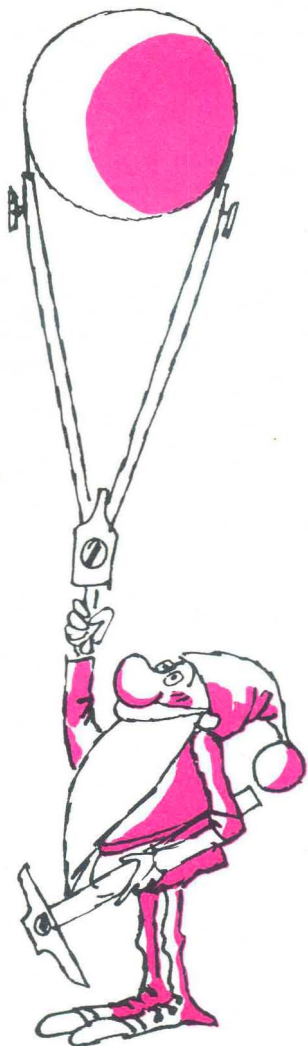
“Because the Earth turns,” added Sveta.

“Perfectly correct, the Earth first turns one side to the Sun, then the other,” said Father.





The diameter of the Moon is 400 times smaller than the Sun's diameter



“That’s why day follows night.”

Then the children began to play. They stuck the pin into the globe in different places and said, “I live here. Is it day or night now?” They would turn the globe and see whether it was night or day in the place where the pin was sticking out.

“Dad, do you remember you told us that the Earth also moved round the Sun?” said Sveta.

Father said,

“That’s right, our Earth not only turns on its axis but it also turns round the Sun. And though the Earth moves very quickly round the Sun, it

only manages to make one circle round it a year because the distance is very great. Sveta will soon be seven years old and will then go to school. How many times did Sveta turn round the Sun together with the Earth during her whole life?"

"Seven times," said Sveta.

"How many times was it winter during that time?" asked Father.

"Seven," answered Sveta.

"And summer?"

"Seven," the girl answered again.

"I know that there's winter and summer every year," said Alex very pleased with himself.

"Do you know that our Earth is a planet?" Father asked the children one day.

"Yes, we do," they replied.

"Are there any other planets besides the Earth?"

"Mars!" Alex shouted out.

"Venus!" cried Sveta.

"And not only Mars and Venus," said Father. "Nine large planets turn round the Sun."

"Nine planets?" Alex was surprised. "But I only know the Earth, Mars and Venus."

"There's Saturn, and other planets," said Father and drew them. "Every planet turns round the Sun along its own path."

"So the Sun has nine children?" asked Sveta.

"I would say they're the Sun's nine closest relatives," answered Father.

"Are there other relatives?" asked Alex.

"Yes, and very many of them," said Father.

"Will you show them to us in the sky?" pleaded Sveta.

The Sun's Family



A comet

"I won't promise to."

"Why?"

"They're either very small planets that can't be seen, or they're tailed heavenly bodies that rarely visit us, called **comets**."

"Where do the planets we can't see live?" asked Alex.

"The largest number of them are between Mars and Jupiter," answered Father.

"And where do the tailed comets live?" asked Sveta.

"They're travellers and live very far from the Sun, farther than the most distant planets," said Father. "And tails appear in comets only when they visit the Sun. These tails are made of dust and gas."

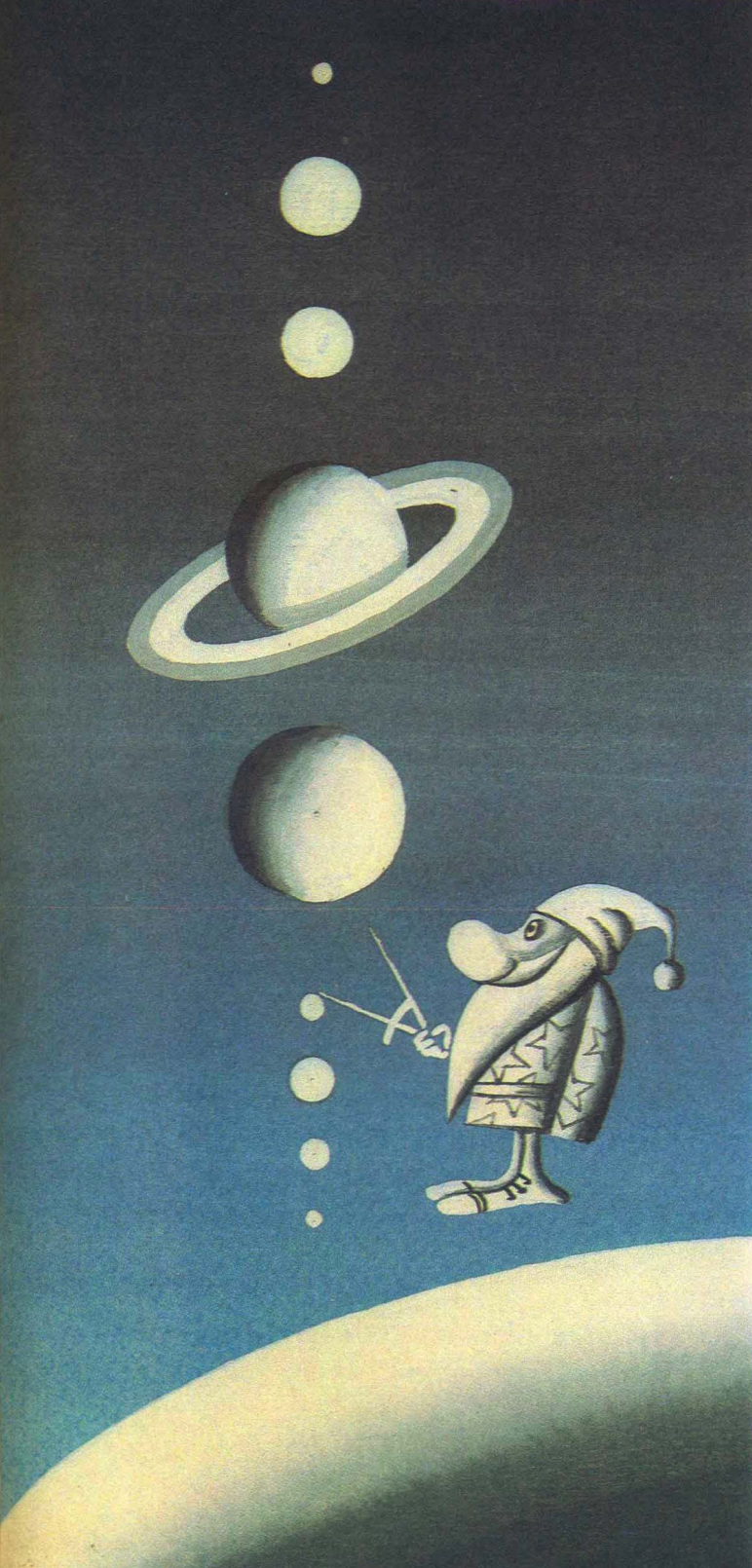
The children looked at their Father's drawing closely and for a long time. Then each of them tried to draw the Sun's family with colour pencils.

"Dad, let's make up a game about the Sun's family," said Sveta.

"Think about it, then perhaps you can make one up yourselves," said Father.

"I've got an idea, we'll make the Sun and the planets out of snow," said Alex.

"Good boy," Father praised Alex. "The Sun will be the largest snowball, and there'll be smaller snowballs round it. They must be placed farther and farther from the Sun. Mercury is the nearest to the Sun. Then comes Venus, which is the same size as the Earth. The fourth planet from the Sun is Mars and after Mars comes the largest planet, Jupiter. It's smaller than the Sun, of course, but larger than any of the planets."



The Solar System consists of the Sun, the big planets and the little ones, the planets' satellites and the comets. This includes the 9 large planets:

**Mercury,
Venus,
the Earth,
Mars,
Jupiter,
Saturn,
Uranus,
Neptune,
and Pluto**

There was a time when people believed that people could reach the edge of the Earth and see what was taking place behind the sky.
Is it really possible?



“I’ve made up another game,” said Sveta.
“We’ll play living planets in kindergarten.”
“Well, you can try it,” Father laughed.

Can People Live on Other Planets?

One day Father said:

“Doc has told me some interesting news.”
“What news?” the children cried.
“Soon you’ll see three planets in the sky, Venus, Mars and Jupiter.”

One night, Father showed the children the three heavenly bodies in the sky. They did not twinkle like the stars but let out a steady light. Mars was reddish, and Venus and Jupiter were a brilliant white. They were even brighter than the stars.

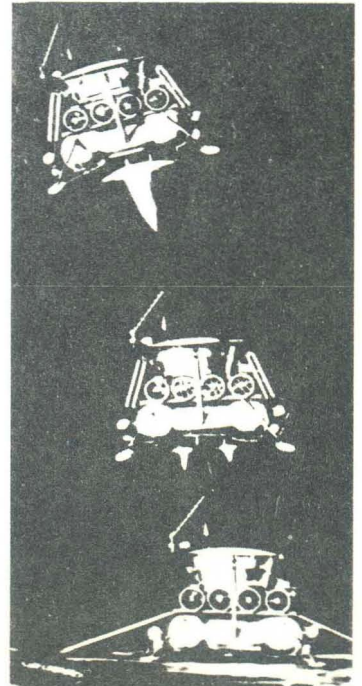
“Dad, the planets are not stars, so you can live on them, can’t you?” asked Alex.

“Of course you can, you live on Earth,” said Father.



The first manned flight into space took place on April 12, 1961. The first astronaut in the world was a citizen of the Soviet Union, Yuri Gagarin

The Soviet Lunokhod (lunar module)



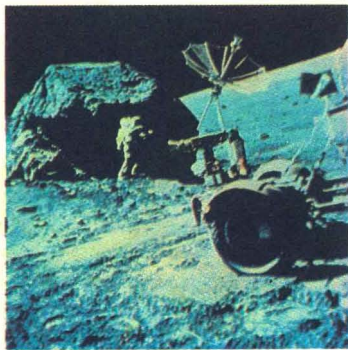
"Do people live on the other planets?" asked Sveta.

"No, they don't, in the Sun family people only live on Earth," answered Father.

"Did the astronauts fly to other planets?" asked Alex.

Father said,

"Not yet, astronauts have flown round the Earth and to its satellite the Moon. **The first man to fly into outer space was a citizen of the Soviet**



American astronauts on the Moon

Union, Yuri Gagarin. Some day, astronauts will fly to the planets, so far scientists and engineers are launching automatic stations which send radio signals from the planets back to Earth. Scientists have learned a great deal about the planets from these signals."

"Dad, did Doc fly to any of the planets?" asked Alex.

"Of course he did. Doc has a magic space rocket. It's easy for him to reach even those planets which belong to other stars..."

"Do the other stars also have planets?" Sveta asked.

"They may well have," answered Father. "Our Sun is a star. There are many such stars as the Sun. That means the other stars looking like the Sun may have planets."

"Like the Earth?" asked Alex.

"They may be like the Earth and they may be different..."

"I'd like to fly to some planets very much," said Sveta.

"Me too," said Alex.



THE PLANETS

The purpose of this last section is to provide children with further details concerning the planets of the Solar System. For many centuries people studied the planets with the naked eye, then, beginning in the 17th century, they used telescopes which have now become highly sophisticated. The new age in the study of the planets has lasted for less than two decades, in which study of the planets has been carried out by means of automatic space stations which have already visited not only the Moon, but also Venus and Mars. These stations have also photographed some other planets from close range (Mercury, Jupiter and Saturn with their satellites). The information obtained as a result of these flights is many times greater than what was known about the planets in former times.





Have you ever felt that life was dreadfully dull? Of course, you must have. That was how Sveta and Alex felt on that day.

"Svet, listen Svet," Alex said to his sister. "Let's play."

"Let's, but what do you want to play?"

"I don't know, let's play a new game," said Alex.

Sveta didn't know any new game. And even their Father whom the children went to couldn't think of anything right away. Then the phone rang. After talking on the phone, Father said merrily,

"Now I know the game we'll play."

"What game?" the children asked eagerly.

"We'll go on a trip. It'll be directed by Doc himself."

"Are we going to fly?" asked Alex.

"We'll play that we're flying," said Father. "Your room will now be a spaceship in which we'll set out on a trip through the Solar System."

"Dad, let's fly to the Moon," Sveta said.

"What for?" Alex disagreed. "People have already been to the Moon."

"It's interesting on the Moon anyway," said Sveta.

Alex would not give in. He thought that if they were going on a magic trip they should go to a place where no one had been. Wouldn't it be interesting to visit Venus and Mars or to go near the enormous planet Jupiter or even reach the farthest planet?

An argument broke out. After arguing the children decided to set out for the planet nearest to the Sun. They already knew that it was Mercury.

Destination: Mercury

Jupiter: you can see two of its satellites (page 104)

Soviet cosmonauts Leonid Popov and Valery Ryumin



Father was appointed commander of the ship, Alex was the mechanic, and Sveta the navigator. The ship was called the *Space Arrow*.

The crew of the spaceship were excited as they awaited the beginning of the flight.

"Ten minutes left," Father and the children suddenly heard as they settled down in the arm-chairs preparing for the take-off.

"Who said 'ten minutes left'?" asked Sveta turning to Father and Alex.

However, her Father and Alex did not answer but watched the TV screen in amazement. Sveta remembered very well that the TV set had been turned off, but now there was light on the screen.

"I did," said a tiny man who appeared on the screen.

"Why, look, Pa, it's Doc the dwarf," said Alex.

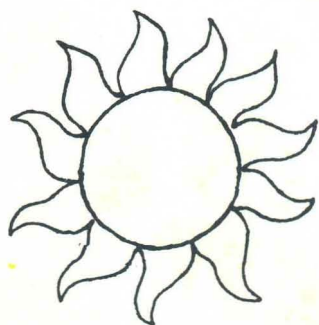
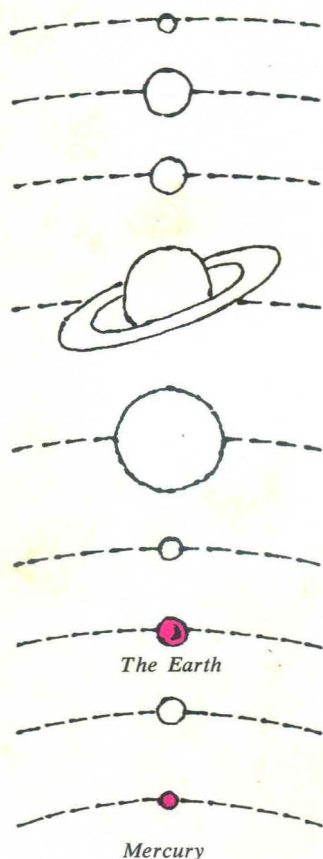
"The *Space Arrow* will leave the Earth presently. Five minutes left," said Doc. "The *Space Arrow* is fully controlled by me, and you will need to help me only on special occasions. The take-off will be very soon. I want the mechanic and navigator to make themselves as comfortable as possible in their seats and prepare for overloads which I hope will not be very great in the magic rocket."

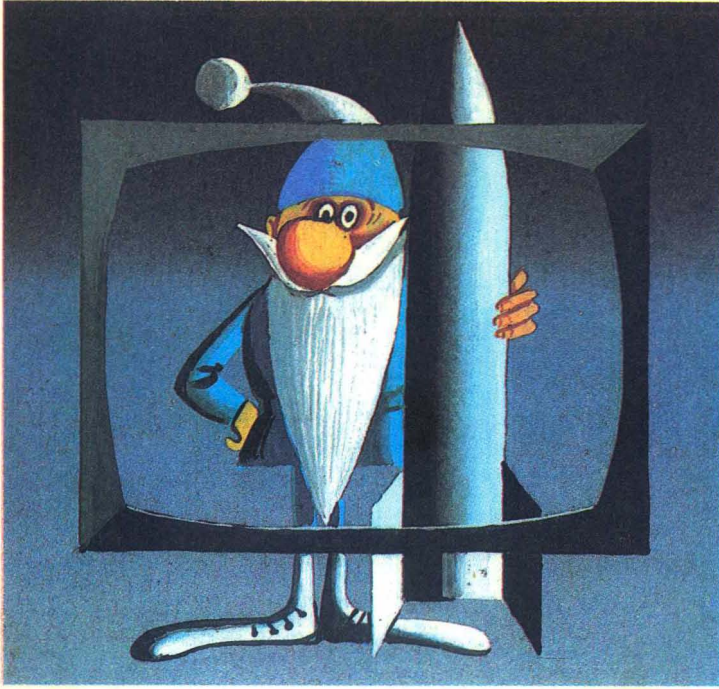
Alex and Sveta had heard the word overload many times. It is not easy for the astronauts when the rocket takes off and gains speed. They are pressed into their seats, so they had to prepare for it?

"One minute left," Doc's voice announced.

"Roger," said Father.

"Take-off in thirty seconds," the crew members heard the countdown. "Twenty seconds, Fif-





teen, Ten, Eight, Seven, Six, Five, Four, Three, Two, One, Ignition."

The crew did not hear the roar of the rocket engines and did not see the blinding flare which usually go with the launching of a space rocket. But the flight began. Doc's magical powers helped the crew get over the overload, and then they became used to the wonderful state of zero gravity in the spaceship.

"Look, children," said their Father. "There's Mercury ahead. It's very similar to the Moon."

The crew leaned against the viewports. The earthlings saw an enormous mountain land covered by craters very similar to those on the Moon.

"Dad, can you see all this in a telescope on

On Mercury



Part of Mercury's surface

Earth?" asked Sveta.

"Of course not," answered Father. "It's very difficult to see Mercury at all. That small planet is too close to the Sun. The fact that Mercury's surface was covered by craters like the Moon's was reported to the Earth by automatic space stations which flew to the planet."

"Attention please," sounded Doc's voice. "The *Space Arrow* is beginning to fly round Mercury. Navigator, report everything you see to the commander."

Sveta began her report,

"I see many many big and little craters. There are mounds at the bottom of some craters. Some other craters are like the Sun with rays stretching out to all sides. Look, what a big crack in the planet."

"It's a very big cliff, it must be thousands of kilometres long," said Father.

"Wow!" the mechanic was amazed.

"Commander! Clouds don't stop us from looking at the mountains and cliffs on Mercury," said the navigator.

"There are never any clouds here, because there's almost no air on this planet," answered the commander.

"The crew are not allowed to land on this planet," ordered the flight controller. "This is a dangerous planet. It has no air or water, and it's very hot in the daytime."

"Like it is in the south?" asked Alex.

"Much hotter," answered Father.

"I know why it's so hot here," Sveta guessed. "Because the Sun's close by."

"That's not the only reason," put in Doc. "A day on Mercury lasts 176 earth days. Nearly half



a year passes on Earth, while only a day ends on Mercury. The Sun heats the surface of the planet very much during such a long day."

"And it's never never cold on Mercury?" asked Alex.

"It is, but only at night. The night's very long, and it becomes very cold while it lasts."

"Cold as it is in winter on Earth?" asked Alex.

"Much colder."

"There are many different things on this planet," said Sveta. "Craters, cliffs, great heat, and terrible cold."

"And there's no air," added Alex.

"Attention please! The *Space Arrow* is leaving Mercury and heading for Venus."

On the Planet of Storms

The magic spaceship continued its flight to Venus. All of a sudden, a siren sounded and signal lights flashed. The ship commander announced:

"Emergency!"

"What's happened?" the children asked in fright.

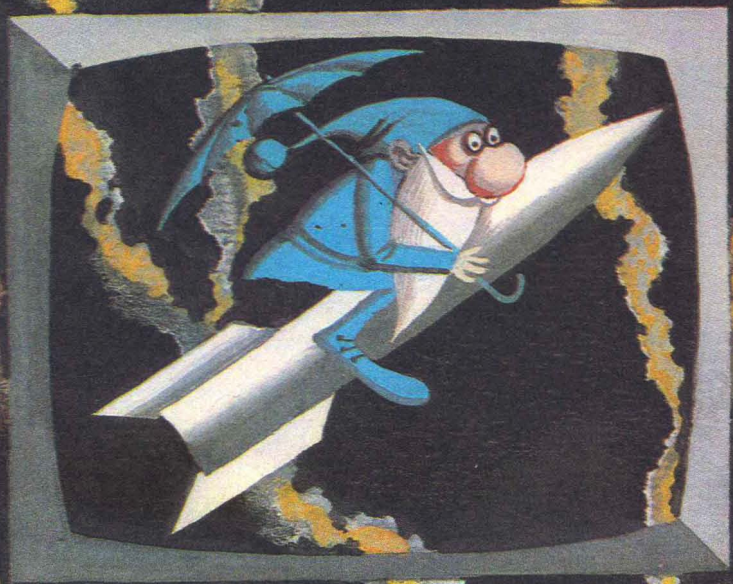
"Don't worry," said Father. "Astronauts must always be ready for unexpected events."

"Watch the instruments, commander!" the flight controller ordered. "Mechanic and navigator, report whether you can see Venus which the *Space Arrow* is approaching."

An unfamiliar dark planet appeared in the viewports.

"Could that be Venus?" Sveta blurted out.

"It's Venus all right," the commander said firmly. "We're flying towards the side of the planet which is not lit up by the Sun, and that's why we see a dark Venus."



"But there's a light on the planet all the time!" cried Alex.

At that instant, the siren sounded again warning the crew of danger. The instrument needles jerked and signal lamps went on.

"There's a strong thunderstorm on Venus now," announced Doc. "You can see the lightning. What is your decision, ship commander?"

"We'll make the ship an artificial satellite of Venus."

"So we won't visit Venus either?" Alex complained.

"Attention! Commander and mechanic, prepare to launch the automatic scout," Doc's voice sounded.

"We're ready," said Father. "We're launching the Magic Bathyscaphe for a flight above Venus."

At this point, the children saw a magic space module on the screen bravely heading for the planet.

"Attention please! This is the Magic Bathyscaphe speaking. I will describe everything I see on this terrible planet..."

"Terrible?" Sveta repeated.

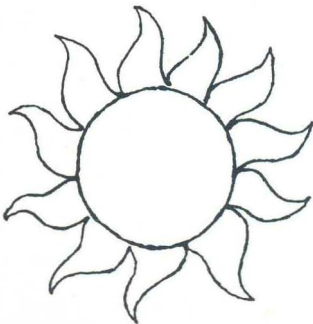
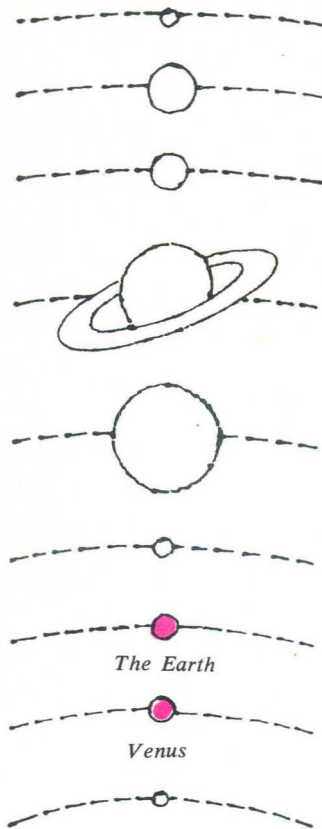
"Yes, it's terrible indeed," said the Bathyscaphe. "There are howling winds here and lightning..."

"You must be drenched by the rain?" asked Sveta.

"Don't you worry, navigator. There should be no rain on Venus. I'm going lower and lower!"

Nothing could be seen on the TV screen, but then the Bathyscaphe reappeared.

"Phew! Phew!" he was catching his breath. "What terrific heat! Don't even think of landing



on this awful planet.”

“There must be too little air,” Alex said.

“Oh no, mechanic, there’s plenty of air, only people can’t breathe it because it’s poisonous.”

“Can you see anything on the planet?” Sveta wanted to know.

“I can hardly see a thing,” answered the Bathyscaphe. “I’m going to fly to the side of the planet that is lit up by the Sun, and then I’ll tell you what I see.”

The TV screen went off. The crew waited eagerly for the Bathyscaphe to begin transmitting again. Shortly, his voice sounded again,

“It’s much lighter here. The sky is a reddish colour but I can’t see the Sun through the clouds. I’m approaching the very surface...”

“Is the surface red too?” asked Sveta.

“No, navigator, the surface is black, as if covered with ashes.”

“Is the surface even?” asked the commander.

“It’s not very even. I can see mountains, craters, deserts, and abysses.”

“Abysses?” Alex was surprised.

“Yes, long and deep cracks,” answered the Bathyscaphe. “I’m trying to look into one of them.”

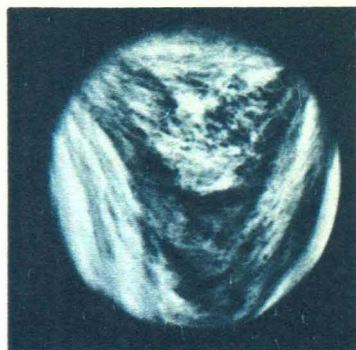
“It must be very dark there?” asked Sveta.

“No, it isn’t. Hot rocks let out light at the bottom of the crack.”

“The Bathyscaphe is to urgently return to the *Space Arrow*!” the crew heard Doc’s order. “The commander and mechanic are to receive the Bathyscaphe and prepare to take leave of Venus.”

“We’re ready!” the commander replied.

“I’m nearing the *Space Arrow*,” reported the



Venus

Bathyscaphe. "I'll be docking in a second."

"Attention please!" Doc's voice was heard once again. "The *Space Arrow* is no longer moving round Venus. It has stopped being its artificial satellite and is heading for Mars. The Bathyscaphe has done his job and is resting. I will allow the crew of the magic spaceship to rest, too."

The Red Planet

"How's the crew feeling?" asked Doc appearing on the screen again.

"Excellent, we've all had a good rest," answered the commander.

"Then get ready to meet Mars," said Doc.

At that moment the lights went out in the planetary ship, but it did not become dark. The reddish light of mysterious Mars came into the ship through the viewports.

"You've had some good luck," reported Doc. "A dust storm has recently ended on Mars after several days. The red dust raised into the air is now settling on the surface of the planet, so you will have a good view."

"It must be very hot on Mars," said Alex.

"Why do you think it's hot on Mars?" asked Father.

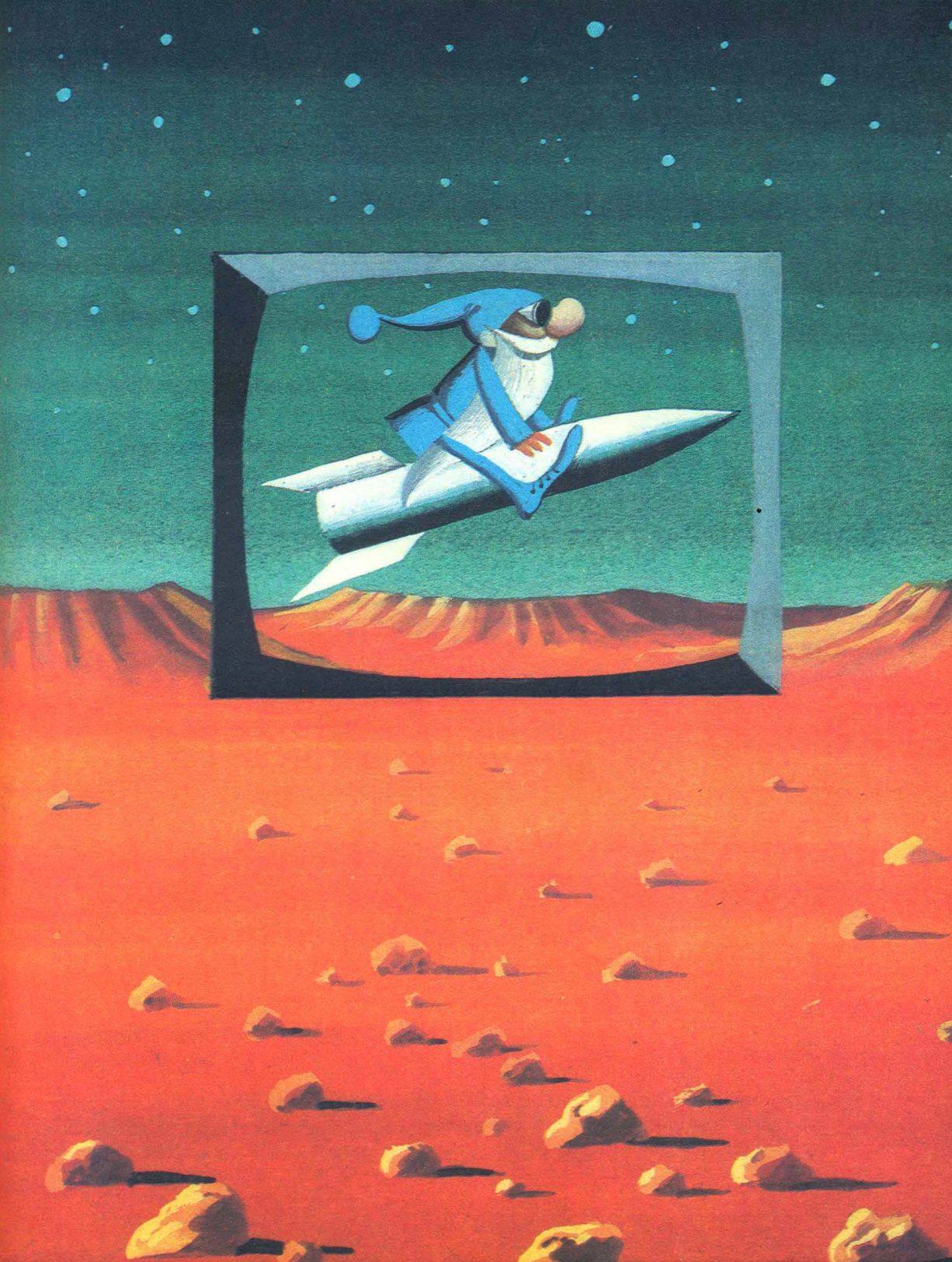
"Because the dust's red hot," answered Alex.

"It's not red from the heat," Father said. "It's just that there's a lot of sand of that colour on Mars. Actually, it's quite cold on Mars."

"Cold like it is in the north on Earth?" asked Alex.

"Sometimes it's even colder," answered Father.

"So we'll have to put on warm clothes to go



for a walk," decided Sveta.

"There won't be any walk," the commander said. "We'll have a look at Mars through the viewports of the *Space Arrow*."

The children were disappointed, but orders were orders.

"Report what you see on the planet," ordered Doc.

"There are enormous deserts strewn with rocks," the commander began his report.

"I can see a huge mountain," said the mechanic.

"Once, flames, clouds of ashes and rocks burst forth from that mountain, but now it's only a dead volcano," said Doc.

"I can see craters like the ones on the Moon and Mercury," said Sveta.

"They're not quite the same," Father said. "There are no winds on Mercury and on the Moon, while the Marsian winds have destroyed some of the craters..."

"Mountains! A whole row of mountains!" Alex cried out.

"Yes, it's quite a large mountain range," Father said.

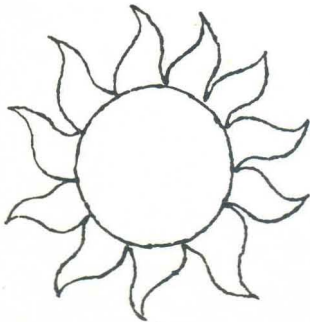
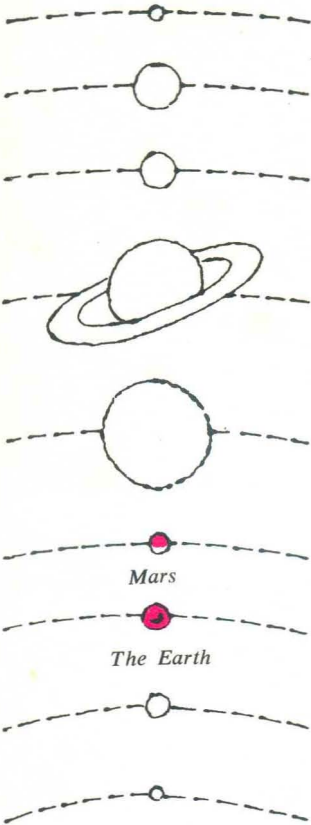
The *Space Arrow* continued to fly round the planet.

"Snow. Snow," said Sveta.

"We're flying over the polar cap on Mars," said Father.

"Does Mars wear a cap?" Alex asked.

"Not one but two at the same time. The Earth also has two polar caps, on the North Pole and on the South Pole, which have a lot of snow and ice, but Mars has little polar caps, and in summer they become even smaller."



"The *Space Arrow* is now flying over the Great Martian Gorge," reported Doc appearing on the TV screen.

It was interesting and a bit frightening to fly over a very long and very deep pit.

"What's on the bottom?" asked Alex.

"No one knows yet," said Father.

Then came the Martian deserts again. One could see many curious things on them. Judge for yourself, there's no water on Mars, so there are no oceans or rivers, but you can see real rivers through the viewports, however, these are not quite real rivers, they're rivers without water, perhaps they've dried out?

"Only recently, earthlings believed that intelligent creatures lived on Mars," said Father.

"People?" asked Alex.

"Not necessarily people," answered Father.

"Earthlings even thought ancient Martians might have left us tokens..."

"What tokens?" Alex was alert.

"Well, for example, launched artificial satellites round the planet."

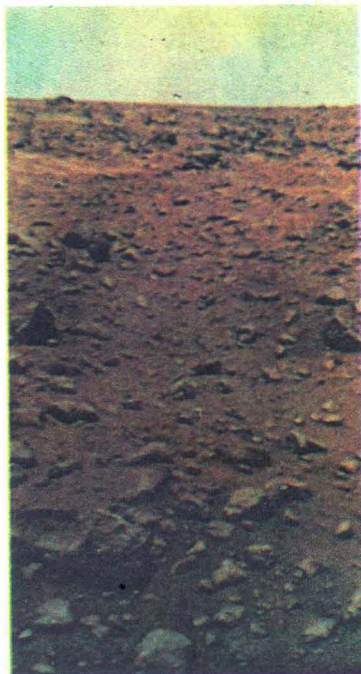
"Are we going to come across these satellites?" asked Sveta.

"Yes, we are, they are not artificial satellites though, but two little moons of Mars," said Father.

"You can now see the Martian moons Phobos and Deimos which mean fear and terror," announced Doc the dwarf.

"What kind of Moon is that?" Alex said in disappointment. "They aren't even round and one is all scratched."

"Yes, the Martian moons don't look like our Moon," Father agreed. "But at least Mars has



Part of Mars' surface

some sort of moon satellites, while Mercury and Venus have none at all."

"Maybe someone does live on Mars?" asked Sveta with hope in her voice.

"Hardly, I don't think so," answered her Father. "Not magic but real spaceships launched by Soviet and American scientists have flown to Mars and they haven't found any signs of life."

"What if we try to find them?" suggested Alex.

Father had no time to answer because the strict voice of the flight controller was heard in the *Space Arrow*,

"The *Space Arrow* is leaving Mars. It is now going to visit another planet, the biggest one."

The crew knew that that planet was Jupiter.

Jupiter and Its Satellites

"We're heading for the last destination on our space travels," said the commander.

"What about the other planets, won't we fly to them?" asked Sveta.

"No, we won't, it's not in our flight programme," answered the commander. "Real spacecraft have already been near Jupiter and Saturn."

"I'd like to fly on a real spacecraft," Alex said.

"I don't know whether you'd like flying for many months at a time," said Father.

"You wouldn't be able to," said Sveta. "Those aren't magic flights but real ones."

"Sveta's right, even real astronauts haven't flown to the planets..."

"Will they?" Alex asked.

"Of course," Father said. "People are only beginning to explore outer space. Many difficult

and interesting flights lie ahead. Having visited the other planets, people will learn a great deal about their own Earth, its past and future."

"Attention please!" the crew heard the voice of the flight controller. "The *Space Arrow* is approaching the dangerous zone round Jupiter. Everyone is to remain in his place. The commander is to prepare the Scout rocket."

Doc disappeared from the TV screen and a small rocket appeared. The crew heard:

"The Scout rocket sends you his greetings. I am the elder brother of the Magic Bathyscaphe and designed in such a way that I do not fear the greatest dangers of the most terrible planet. There are TV cameras on board which I'll turn on for you to see the most interesting things. Excuse me, someone's calling me over the radio..."

The Scout appeared on the screen again:

"Crew, I'm being called by a comet from the family of giant Jupiter."

"Look! Look! There's a tailed star on the screen," cried Sveta.

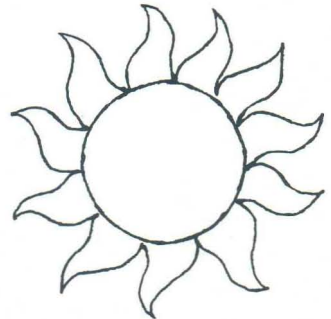
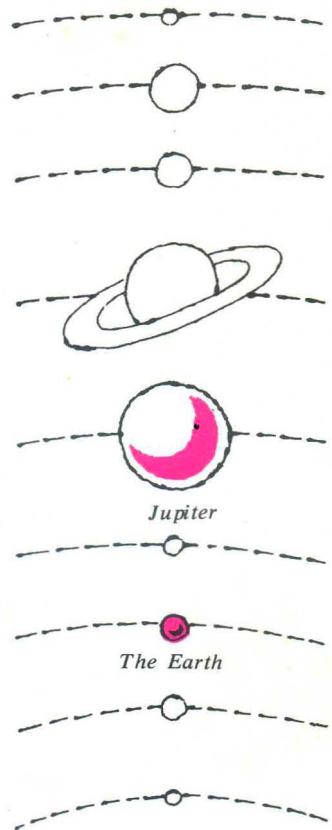
"That's the comet," Father said.

They heard from the screen:

"Scout speaking! Scout speaking! I'm transmitting a report which I received from the comet by radio. It's very troublesome in the Jupiter family which consists of the planet itself and its satellites. Jupiter is storming so strongly it's dangerous to approach it even for me. Volcanoes on some of Jupiter's satellites are giving out flames. Be careful! Be careful!"

"What should we do?" the mechanic asked the commander.

"That must be decided by the flight control-



ler," answered the commander.

Doc the dwarf always appeared at the most difficult points in the trip. Now, too, he was already there.

"I still want to show you Jupiter's moons and Jupiter itself," said Doc calmly. "But it's dangerous to approach the planet. The *Space Arrow* will move round Jupiter at a large distance, while the Scout will fly closer to the planet."

"And will it land?" Alex asked.

"There's absolutely nowhere to land, the Scout cannot land on clouds, and no one has discovered a firm surface on Jupiter yet. Perhaps, the giant has no firm surface at all."

Doc disappeared, and a strange picture appeared on the screen.

"I'm showing you the surface of Jupiter's satellite called Callisto," roared the Scout's voice. "Look how many craters there are here. More than on the Moon, Mercury and Mars. You can see the Bull's Eye volcano, Callisto's main crater. There are waves running from it in all directions. But these are dead waves, they have long been frozen on Callisto's ice sheet."

The crew examined Jupiter's remarkable moon with bated breath.

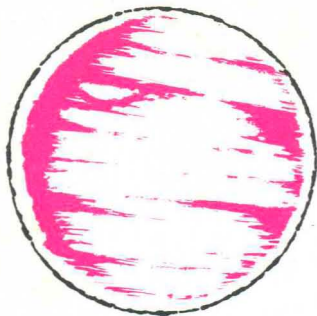
"I'm turning on Ganymede," announced the Scout.

"What's he turning on?" Alex was at a loss.

"He'll show us another satellite now which is closer to Jupiter than Callisto," said Father. "Navigator, report what you see on Ganymede."

"There are many beautiful craters with rays





Jupiter's family

here. They are like big snowflakes," Sveta began.

"There are many different mountains and cracks here too," Alex added.

"Ganymede looks like the Moon," said Sveta.

The Scout appeared on the screen again.

"Jupiter has 14 satellites, but I'll show you only two, the two closest. One is called Io, the other Amalthea. You can already see Io clearly."

All of a sudden, the whole ship was lit up by the glow from an enormous flame which burst from an active volcano and rose above the surface of Io.

"We've never seen anything so beautiful before," whispered Sveta.

"The crew of the *Space Arrow*," the Scout's voice was heard. "I can't stay near Io for long. I'm heading for Amalthea."

"I can see Amalthea!" shouted Alex. "It looks like a cucumber."

The picture on the TV screen changed.

"Attention! You can see thundering Jupiter," sounded the Scout's voice.

"Is it thundering because there are thunderstorms on it?" asked Alex.

"Yes, it is, the thunderstorms on Jupiter are much stronger than they ever are on Earth or Venus," answered Father. "Besides that, Jupiter consists of whirlwinds. Look what's happening on that planet."

Something incredible was taking place on Jupiter. The planet seemed to be made up of whirlwinds of different colours. The Scout aimed the TV cameras at these whirlwinds, but most

frequently, he showed a large red spot.

"What's that?" asked Alex.

"That's the Great Red Spot," answered the Scout. "It's an oldtimer. The Earth's astronomers have observed it for three hundred years. A lot has changed on Jupiter in that time, but the Great Red Spot remains."

"Listen, Scout, could you have a look under the whirlwinds?" asked the mechanic.

"No, Alex," Sveta said. "He'd never get out."

"The flight controller doesn't allow me to go swimming and diving in Jupiter's air," said the Scout.

"Can you breathe that air?" asked the mechanic.

"Jupiter's air can't be breathed at all," answered the Scout.

"So you really can't live on the planet of different coloured whirlwinds," the mechanic said in disappointment.

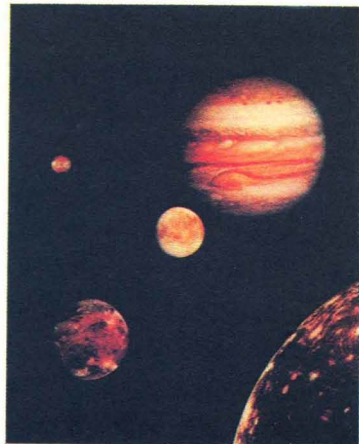
"I'd like to show you many things," continued the Scout. "For example, you haven't seen Jupiter's Northern Lights."

"Please show us the Northern Lights," the children called out.

"All right," the Scout promised. But there was no time for him to keep his promise. Suddenly, it grew dark in the *Space Arrow*. The lights went out, the TV screen was switched off and nothing could be seen in the viewports of the Magic spaceship.

"What happened?" Alex asked in excitement.

"Everything's all right," replied Father. "Our magic space trip has ended." He turned on the lights in the room and added, "We're home again."



Jupiter with some of its satellites

What Does Dopey Know About the Stars and Planets?

In the last talk, the reader meets Dopey the dwarf once again. The purpose of the meeting is to check what the children have learned about the stars and planets. After carefully listening to Dopey's story, the children should point out his mistakes and also try to correct them.

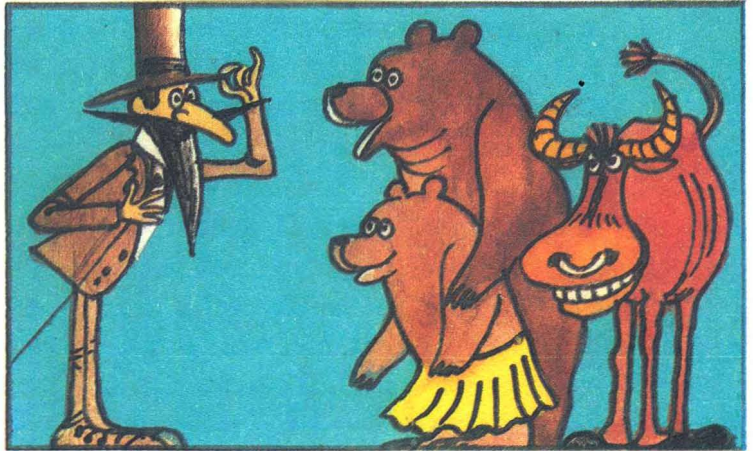
DOPEY'S STORY

"Honorable dwarfs, I'll tell you how I once made a remarkable journey to the sky and the stars," began Dopey. "I remember that I flew from Earth at night. Of course, I reached the stars in the sky very quickly. What did I find there but a zoo!"

"Only the animals are not in cages but walked around freely. I met the Great Bear with her daughter and also the Bull. I almost fell down to Earth in fright when I saw the terrible sea monster. Fortunately, I managed to hide in Cassiopeia's palace."

The Chief Magician was very angry. He had only just learned from Doc how many mistakes Dopey had made when he had talked about the Sun. The Chief Magician decided to punish Dopey strictly. But Dopey said that he had been nervous which was why he had got everything mixed up about the Sun. He knew everything about the stars and planets and could tell about them at any moment without any mistakes.

"Well, Doc and I will listen to you now," growled the Chief Magician.

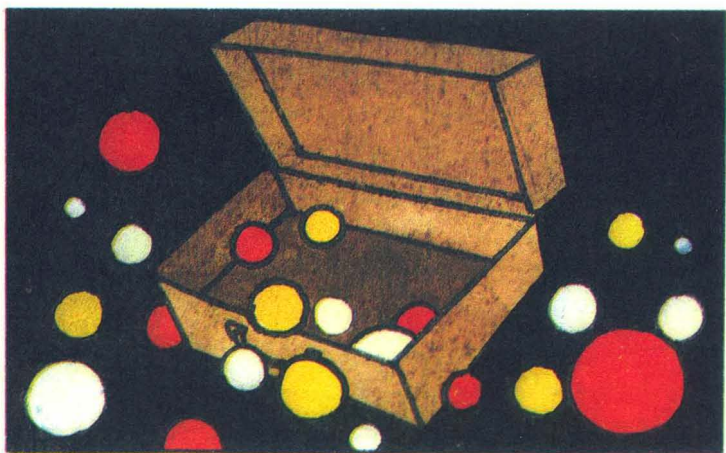




"I felt poorly and was grateful to the kind and modest Queen Cassiopeia who sent her ugly daughter Andromeda for some water. The princess went out of the palace, took a big dipper and filled it with some water from an ocean on the Moon. I drank all the water and felt better. King Cepheus himself showed me the main highway in the sky which can be seen even from the Earth. It passes through the whole sky and is called the Milky Way because Cepheus' servants pour milk over it every night.

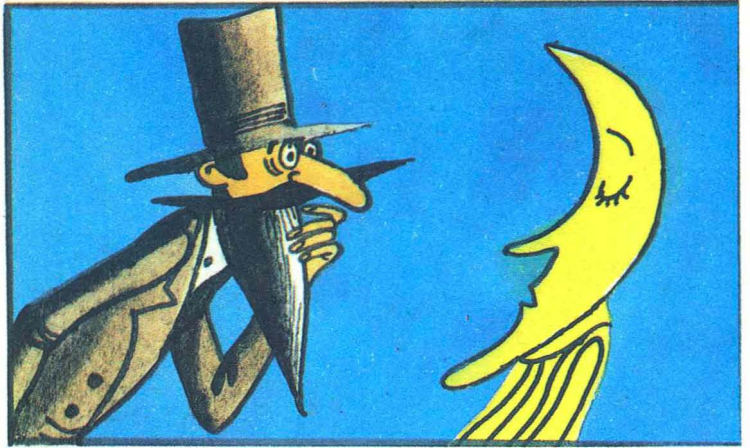


"It's not very easy to walk on it because it's very slippery. Then King Cepheus invited me to his palace. As soon as we entered it, our Moon came running in crying. Her face was all scratched: she had brushed against the Earth's axis. We comforted her, but she said she was not screaming and crying because of the scratches at all.



"She opened her suitcase and scattered different coloured balls from it all over the floor. She had collected stars from the sky, and the stars had fallen ill. Cepheus and I had to measure their temperatures by means of a thermometer. The red stars were the hottest, of course, and the coldest were the white stars.

"While we were measuring temperatures, the poor Moon was very upset. She had come to us very fat, but as she sat she grew thinner and thinner and melted completely away. Then we..."



"Stop, that's enough, my dear friend," the Chief Magician could stand it no longer. "You haven't gone on a trip through the sky at all, you've just made it all up and got everything mixed up as usual, you don't really know anything."

Dopey began to cry and asked to be forgiven, but the Magician would hear nothing of the sort. He ordered Dopey to be sent to a distant planet where there was a large library from olden times. The Chief Magician said he would allow Dopey to return only when he had read all the books in the library and could become clever and educated.

When Father heard that story from Doc he retold it to Sveta and Alex. Once again, the children had to count Dopey's numerous mistakes. Perhaps they were not the only ones to notice the mistakes in Dopey's story. Now you, boys and girls, know a great deal about our Earth and the Moon, about the other planets, about our Sun and the stars, very faraway suns. When you grow up, you must learn a lot more.

Dear Mothers
and Fathers,
Grandmothers
and Grandfathers!

Now that you have read
your children this book
please let us know whether
the children were interested,
and what they liked most of
all. Send your letters to 17,
Zubovsky Boulevard,
Moscow, USSR.



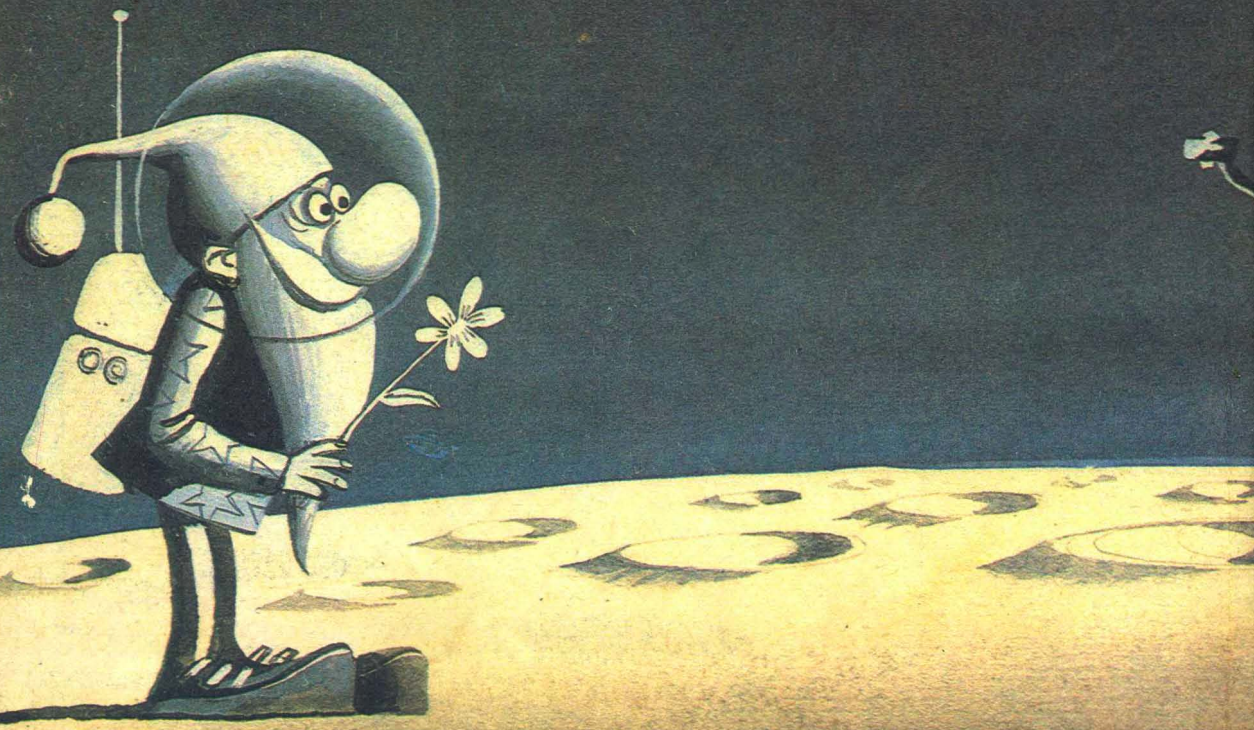
Перевод сделан по книге:
Е. Левитан. Малышам о звездах и планетах.
М., «Педагогика», 1981 г.

Для совместного чтения и занятий
родителей, воспитателей с дошкольниками
и младшими школьниками.



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Raduga Publishers
Moscow

ISBN 5-05-000666-X